SERVICE NOTES
VIDEOPROJECTOR
WITH BS950 CHASSIS

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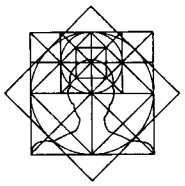

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SERVICE NOTES OF VT 150 VIDEO PROJECTOR

MAIN CHASSIS (BS950)

The main chassis is similar to the digital CTV chassis; the main modification respect to the CTV digital chassis are:

- Switch Mode Power Supply Transformer: 130 V output to supply the horizontal deflection.

- EHT transformer: the EHT winding is not wired because the EHT voltage is supplied by special EHT circuit coming from EHT module.

- Integrated Circuit CI351 (TDA4950), that is supplying the drive waveform to the modulator diodes, is receiving, on the input pin 7, a saw-tooth waveform coming from the convergence module that allows skew correction on horizontal deflection used to adjust the videoprojector when it is tilted in respect to the screen.

On BS950 chassis, moreover, there is a 150 V negative voltage supply, obtained with D411 and C358, going to the EHT module. This negative voltage is used to cut-off the three CRT G1 grids during switch-off of the set, or when beam protection starts working, to avoid spots on the picture tubes (to avoid phosphorus burning).
From BS950 chassis are going out various signals and pulses used on other videoprojector modules and these signals will be described later during modules descriptions.
The digital module inserted on the Videoprojector digital chassis BS950 is equal to the one mounted on digital CTV's; the only difference are.

1) CCU SECO22 microprocessor specifically used for videoprojector because it allows quadristandard video signal handling.

2) Six wire to connect Scart socket to BNC module BS824.

3) 4 Kbyte memory (2 kbyte on CTV's) with specific videoprojector data inserted.

Audio module is different from the CTV corresponding modul due to the fact of the insertion of one shielded cable connecting the audio module itself to the BNC module BS824.

POWER SUPPLY MODULE (BS 820)

On the power supply module are mounted two different circuits and, namely, the switch mode power supply from which are generated 130 V c.c. EHT generator supply and the +/- 19 V c.c. and the +/- 15 V c.c. used on convergence stages and the protection circuits (working when horizontal and/or vertical deflection are missing).

Module inputs/outputs		Coming from/Going to
CL1 CL2	220 Vac input	From mains filter module BS823
FV1 FV2 FV3	Ground - 19 v c.c. + 19 V c.c.	Not used
AV1 AV2	Ground + 15 V c.c.	Fan supply
PC1 PC2 PC3	Ground - 15 V c.c. + 15 V c.c.	Convergence output module BS819 supply
CG1 CG2 CG3	- 19 V c.c. + 19 V c.c. Ground	Convergence adjustment module supply
YB1 YB2 YB3 YB4 YB5	Horizontal joke (High pin) Horizontal joke (Low pin) Not connected Vertical joke (Low pin) Vertical joke (High pin)	To the blue CRT deflection coils (yoke)
YG1 YG2 YG3 YG4 YG5	YR1 YR2 YR3 YR4 YR5	To the green and red CRT deflection coils
BL2 BL3	L1602 linearity coil	To BS820A module
G1 G2 G3 G4 G5	Horizontal flyback input Horizontal flyback output Ground Vertical flyback output Vertical flyback input	From BS950 chassis

EC1	960 V c.c. (G2 bias)	To BS776 EHT module
EC2	18 V c.c. (during stand-by)	
EC3	Ground	
EC4	0,3/18 V c.c. protection with	
EC5	8,2/0 V c.c. no deflection	

The switch mode power supply (on the BS820 module) is like the one used on BS950 chassis. This power supply gives three output voltages:

. + 130 V c.c. to supply the EHT circuit generator.
. + and - 20 V c.c. from wich there are derived + and - 15 V c.c. by means of the stabilizer integrated circuits CI1602 and CI1603.

This supply is off during stand-by condition due to the FD1601 photo-coupler action; in fact, as can be seen on the schematic diagram, during stand-by condition about 4 V c.c. are coming from the chassis to pin 6 od EC connector and, consequently, photo-diode is on, photo-transistor is in conduction and pin 5 of TDA4601 (CI1631) is pratically grounded. In this condition the driver pulses to T1601 (BU508 A) are cut-off and the power supply is off.
When the Videoprojector is switched on, pin 6 of EC connector is going to approximately 0,4 V c.c., photo-diode and photo-transistor are cut-off and pin 5 of CI1631 is going to 7 V c.c. and, in this condition, the power supply starts working supplying the relevant circuits.
Protection circuit against deflection failure works in the following way: coming from the BS950 chassis there are 4 connections (G1-G5 connector) that are connecting the deflection coils to the relevant circuits on the main chassis. The current reading transformer are series connected with the connecting wires.
The three series connected vertical jokes are, also, series connected with the primary winding of TR1602 transformer.
The three horizontal deflection coils are connected in parallel, and every one is series connected with the primary windings of, respectively, TR1603-TR1604 and TR1605 transformers.
On the secondary windings of the transformer will be present a voltage depending on the amount of the primary current and these voltages will be rectified and clamped by D1616-D1623 diodes; to these voltages will be added a negative voltage by means of adjusting potentiometers.
These potentiometers will be adjusted to obtain, with correct deflection, 5,4 V c.c. on the three horizontal and 6,5 V c.c. on the vertical inputs of the 4 comparators IC (CI1604).
When the sistem is working properly, the four comparator outputs, interconnected, are High (about 15 V) and, conse-

quently, pin 4 of EC connector will be at 0,3 V c.c. and pin 5 of the same connector will be at 8,2 V c.c.
When the set is not working properly or when one of the deflection currents is missing, one, at least, of the four comparator inputs will be going under common reference voltage (about 3,6 V c.c.) and his output will go to Low (about 0 V) forcing to Low all other outputs; T1604, consequently, will start conducting ligting DL1601 LED diode that will indicate faults on deflecion circuits.
In the same time the comparators output will cut-off T1602 and the voltages on pin 5 and pin 4 of EC connector will change to, respectively, 0 V c.c. and 18 V c.c.
The 0 V c.c. on pin 5 of EC connector will be sent to BS776 EHT module (pin 5 of CM connector and to pin 9 of CI1231); the output of this IC, pin 14, will go to Low level and this will reset the videoprojector that will go in stand-by condition.
The 18 V c.c. on pin 4 of EC connector are sent, via pin 4 of CM connector, to D1236 diode that will be cutoff; transistor T1238 will, consequently, switch from conduction (in this condition is grounding the 150 V c.c.), to cut-off condition and, in this case, -150 V c.c. will reach the three picture tube G1 (via ED1), cutting-off the picture tubes itself, avoiding burning of phosphorous due to beam current flowing without normal deflection.

Note: when the videoprojector is in stand-by condition, DL1601 LED is lighted because it is supplied with the 18 V c.c. coming from BS950 main chassis, via pin 2 of EC connector, whereas the four comparator outputs (CI1604) are Low level because the IC supply is coming from the switch mode power supply BS820 module that is not working in stand-by mode.

BS823 MAINS FILTER MODULE

On this module, located on the front of the videoprojector, near the bleu picture tube lenses, are mounted the two mains filter circuits. The 220 V c.a., coming from the mains switch of the front panel, are going to the two Switch Mode Power Supply circuits that are located, respectively, on BS950 chassis and on BS820 supply module.
On this last module can be found, also, the fuse protecting the supply in case of short-circuits.

BS840 VIDEO INTERFACE MODULE

BS840 video interface module is used to distribute the video signal coming from BS815 digital video module, mounted on BS950 main chassis, and the power supply voltages, coming from EHT module, to the three picture tubes and to the three relevant video output modules.
The connectors of this module are:

	Module Inputs/Outputs	Coming from/Going to
DC1 DC2 DC3	Three cathodes cut-off voltage during convergence.	To BS813 convergence adjustment module.
M1	Red cathode drive.	From BS815 video module (mounted on main chassis).
M2	Ground.	
M3	Green cathode drive.	
M4	Ground.	
M5	Bleu cathode drive.	
M6	Ground.	
M7	+ 12 V c.c.	
M8	Voltage proportional to beam current (for Cut-Off adjustment).	
ED1	G1 voltage for all three picture tube (0,5-140 V c.c.).	From BS766 EHT module.
ED2	G2 voltage for red picture tube (500-760 V c.c.).	
ED3	G2 voltage for green picture tube (500-760 V c.c.).	
ED4	G2 voltage for blue picture tube (500- 760 V c.c.).	
ED5	G3 voltage for all three picture tube (150 V c.c.).	
V1	G2 voltage, red picture tube.	To red picture tube video output module. Same applies to green and bleu video output module.
V2	Ground.	
V3	6,3 V for red picture tube filament.	
V4	G1 voltage (0,5-140 V c.c.) for red picture tube.	
V5	+ 200 V c.c. supply to red video output module.	
V6	+ 150 V c.c. G3 biasing voltage for red picture tube.	

Z1	Driver signal for red video output stage.	To BS812 red video output module. Same applies to green and bleu picture tube.
Z2	Ground.	
Z3	Biasing voltage for red video output amplifier (about 4 V c.c.).	
Z4	Supply voltage of video output first stage (+12 V).	
Z5	Voltage of cathode current reading.	

On this module can be found, also, the circuit comprising T1100 and P1101 that are used to produce low impedance voltage (4-5 V c.c.) necessary to stabilize the working point, and consequently the amplification, of T1191 (BF758) transistorthat is mounted on video output module.
The P1101 trimmer adjustment is factory made and must be not adjusted during videoprojector installation. The circuit R1104 and C1105, on T1100 base, is producing one negative pulse during videoprojector switching-off to cut-off instantly the video output transistors to avoid spots on picture tubes that can damage the phosphourus of the picture tubes themselves.

BS812 VIDEO OUTPUT MODULE

The video output module is receiving the signal coming from the digital video module, via the video interface module, and the voltages used for picture tube biasing.
The video signal, amplified in this module, will be sent to the drive pin (8) of the relevant picture tube AVB22; the connector of this module are:

Module Inputs/Outputs		Coming from/Going to
V1	G2 voltage (500-760 V c.c.).	From video interface module (BS840).
V2	Ground.	
V3	Filament voltage (6,3 V a.c.).	
V4	G1 voltage.	
V5	Video output power supply (+200 V c.c.).	
V6	G3 voltage (+150 V c.c.).	
Z1	Video signal input.	From video interface module (BS840).
Z2	Ground.	
Z3	Amplifying stages biasing voltage.	
Z4	+12 V c.c. power supply.	
Z5	Cut-off control output.	

As already said, the main purpose of this module is amplification of the video signal, coming from the digital video module of the main chassis BS950, to obtain one signal amplitude of 80-90 V p.p. with the standard test pattern.
T1190 transistor, connected in emitter-follower configuration, is inserted to obtain very low loading capacitance to the video signal generator and,in the same time,an high current gain to drive T1191 video amplifier on all the bandwith. This last transistor is amplifying the video signal about 20 times and his load is composed of R1194 (18K) and of T1192 transistor connected in emitter-follower configuration to obtain a generator with very low output impedence for the CRT cathode.
The amplified video signal coming from T1192 emitter, is reaching the picture tube cathode via D1191 and the series connected R-L components R1198-CH1190 with the purpose of frquency compensation of input CRT capacity.
T1193 is measuring the cathode cut-off voltage (black level) during vertical blanking, and, in this way, the video processor can adjust the video output signal to keep costant, in the range where it is feasible, the black level that can vary with the aging of the picture tube or other components.

EHT MODULE AND EHT TRANSFORMER MODULE

The two modules BS776.2 (EHT) and BS825.1 (EHT transformer), are generating the EHT stabilized voltages (29 KV); on the EHT module there are, also, protection circuits that brings the machine, if working, in stand-by condition during faulty conditions.

	Module Inputs/Outputs	Coming from/Going to
DG1	-150 V c.c.	From BS950 chassis.
DG2	+18 V c.c.	
DG3	Ground.	
DG4	Horizontal driver.	
DG5	On/Off signal.	
DG6	RESET.	Going to pin D'8 of video module.
DG7	Voltage proportional to the beam current (for beam limiting).	Going on R314 and R314A and on pin C'8 of video module.
DG8		
CM1	+960 V c.c.	From BS820 supply mod.
CM2	+18 V c.c.	From BS950 main chassis.
CM3	Ground.	
CM4	Anti spot protection level.	From BS820 module.
CM5	Protection against deflection failure.	From BS820 module.
CM6	On/Off signal.	From BS950 main chassis via DG5.
CM7	+130 V c.c. (EHT module supply).	
ED1	+0,5 4V ON/-140v (stand-by).	To BS840 video interface module.
ED2	G2R bias voltage.	
ED3	G2G bias voltage.	
ED4	G2B bias voltage.	
ED5	+150 V c.c. G3 bias voltage.	
SF1	Ground.	From BS825.1 trafo mod.
SF2	Not connected.	
SF3	EHT sample voltage (1,6 V).	
TE1	EHT flyback (1.000 V p.p.).	From BS825.1 trafo mod.
TE2	120 V c.c. power supply.	To BS825.1 trafo module.
TE3	Beam current reading.	From BS825.1 trafo mod.
TE4	Ground.	

On the EHT circuit (29 KV), similar to a normal line output stage, TR1295 horizontal transformer is connected to the output transistor T1232 and receives the driving signals coming from T1231 driver transistor via the driver transformer TR1230. Emitter-follower T1230 is added to this normal line output stage to avoid excessive load to the square wave generator of the main chassis digital module BS950.
The secondary winding of TR1230 driver transformer and the emitter of BU508A (EHT output transistor) are not directly connected to ground as in normal horizontal output stages but are connected to power transistor collector T1223 that is working as a variable resistor drived by CI1230 comparator via T1236 and T1234.
On pin 2, inverting input, of CI1230 comparator is applied the reference voltage adjustable with P1230 and on pin 3, not inverting input, is coming the voltage (about 1,3 V) from the resistive network composed of 300 Mohm resistor (on the EHT voltage divider) and the parallel connected resistors R1295-R1296. The voltage on pin 3 is, consequently, proportional to the EHT voltage and the comparator output (pin 6) depends on this voltage and the reference voltage.
The output voltage (pin 6) of CI1230 is current transformed with T1235-T1236 and the corresponding current is applied to T1233 base that, in this way, will conduct proportionally to the operational comparator error.
If, for instance, the EHT voltage starts increasing, due to beam current decrease, the comparator output increases, T1233 will be reducing conduction and the collector/emitter voltage (VCE) will be increasing; this increase will be subtracted to the EHT stage power supply lowering the EHT to normal value.
If EHT, instead, is decreasing (beam current increase due to bright picture), T1233 will be conducting more current, VCE voltage will decrease, increasing the voltage of the EHT generator.
With this circuit it is possible to stabilize the EHT voltage and to adjust the correct value with P1230 that is adjusting the reference voltage for CI1230 comparator.
With T1239-C1242-D1239 circuit it is possible to obtain a slow rise of EHT voltage; this can be reached slowing down the building-up of the 1,3 V c.c. reference voltage, during switch-on, reducing, in this way, stress to EHT circuits and to CRT's and avoiding, also, flash-overs that can damage other videoprojector circuits.
In stand-by condition T1239 is cut-off because the base is kept below 5,1 V by means of CI1231 comparator output pin 14, through R1288 and D1239.
Pin 14 comparator output is low level because the non-inverting input (pin 9) is low level (about 0,3 V), due to

the fact that the protection circuit of BS820 supply module gives low level to pin 5 of CM connector when deflection is not yet working, and the inverting input (pin 8) is biased to reference voltage (about 1 V) by means of DZ1237 zener diode and R1281-R1282 network; this circuit is working with 18 V c.c.(always present in stand-by condition) coming from the main chassis BS950 through pin 2 of DG connector.
When the projector is switched ON the inverting input (pin 10) of CI1231 is going to low level, through C1259, for the time depending on time costant C1259/R1285.
Pin 13 output is going to High level together with pin 9, second comparator, for some milliseconds; during this time deflection circuits are reaching normal condition and, consequently, on pin 9 will be coming, from pin 5 of CM connector, positive voltage corresponding to the deflection presence (see relative description on supply module).
In the same period CI1231 pin 10 will change to High level (C1259 is now completely discharged) and pin 13 output is switching to Low level but this will not move the second comparator input pin 9 because D1238 will be reverse biased; the circuit is now prepared to start again if the videoprojector will be switched OFF and ON again.
The other two comparator inside CI1231 are used to protect the circuit against EHT voltage rise or increase of beam current.
On the upper comparator, pin 4 ,inverting input, is applied the reference voltage (about 1 V) and on pin 5, not inverting input, the adjustable voltage proportional to beam current (adjustable by means of P1231).
On normal condition pin 5 voltage is always higher than 1 V and, consequently, pin 2 output is at High level (+ 15 V).
If beam current is increasing too much, voltage on junction R1255-R1257 will decrease, as well as the voltage on CI1231 pin 5; when this voltage will be lower than that of pin 4, the comparator output pin 2 will go to Low level and D1239-D1239A will start conducting.
Transistor T1239 will be cut-off and, consequently, CI1230 pin 2 will go to Low level reducing EHT stage supply voltage that in this way will be reduced.
In the same time D1239A conduction will decrease the reset voltage on the digital module of BS950 chassis with the result that the videoprojector will go in stand-by condition.
On the lower comparator non inverting input, pin 7, is applied 1 V reference voltage and on the non inverting input, pin 6, is applied an EHT depending voltage, coming from the voltage divider 300 Mohm and R1295-R1296 parallel resistors mounted on EHT transformer module.

This voltage is applied to P1235 from pin 3 of SF connector; P1235 adjustment will adjust the intervention point in case of EHT increase, and, normally, is facory adjusted to 31 KV.
If the EHT voltage will increase to higher values, the comparator output (pin 1) will be going to L (Low level), D1239 and D1239A will start conducting and the projector, as said, will go in stand-by condition.
On the comparator n.3 (pin 9), non inverting input, is applied, normally, a voltage higher than 1 V but in case of deflection failures this voltage, coming from pin 5 of CM connector, will be going to L (Low level); pin 14 output will go to Low level and D1239- D1239A will start conducting and the videoprojector will switch to stand-by condition.
On the EHT module is mounted, also, the protection circuit T1238-D1236-R1266-R1265; normally D1236 and, consequently T1238, will be in conduction by means of the Low level (about 0 V) coming from pin 4 of CM connector of the supply module.
The transistor collector, in this condition, will be at 3 V c.c. that are forwarded to the three n. 1 grid through pin 1 of ED connector. In case of deflection failures or when videoprojector is switched-off D1236 cathode will be biased with 15 V going cut-off and, consequently, also T1238 will be cut-off.
In this condition T1238 collector will go to -150 V, coming from pin 1 of DG connector from BS950 main chassis, and this negative voltage will be applied to CRT's first grids cutting-off beam current preventing, in this way, phosphorous burning.
On BS776.2 module are mounted, also, P1232-P1233-P1234 that are used to adjust the CRT's grids n. 2; on the projector are applied 960 V c.c. coming from pin 1 of CM connector and the adjusted voltages are going out, through ED connector, to the corresponding n. 2 grids.

Attention: the potentiometers mounted on this module are factory adjusted and do not need adjustment during normal service or installation of the videoprojector.

BS813 CONVERGENCE ADJUSTMENT MODULE

To obtain convergence of the three, R - G - B pictures, it is necessary to drive the convergence coils with proper signal waveform: vertical and horizontal saw-tooth and parabola signals and combinations of the same.
On BS813 module are mounted the circuits, that are generating this kind of signals, working-out the vertical and horizontal signal coming from BS950 main chassis; on the same module can be found the potentiometers used to adjust the currents to be sent to the convergence coils.
On the same module are inserted, also, the circuits generating the waveform needed for corner convergence adjustments, the convergence signal generator (cross-hatch) and three switches to cut-off individually the three picture tube during videoprojector convergence adjustment.

Module Inputs/Outputs		Coming from/Going to
FC1	Vertical saw-tooth.	From BS950 main chassis.
FC2	Ground.	
FC3	Horizontal flyback.	
FC4	Ground.	
FC5	Vertical saw-tooth output.	
CG1	- 20 V c.c.	
CG2	+ 20 V c.c.	
CG3	Ground.	
DC1	Vertical blanking pulse (1,4 msec.), or 15 V c.c. to cut-off, alternatively, the three picture tube during convergence adjustment.	To BS840 video interface module.
DC2		
DC3		
AS1	Cross-hatch signal.	To BS761 (on BS950 main chassis) audio module.
AS2	Ground.	
RF1	Different signals coming from convergence adjustment module potentiometers.	To BS819 convergence output module.
RF2		
RF3		
RF4		
RF5		
RF6		
RF7		

Horizontal flyback from BS950 main chassis is arriving on pin 3 of FC connector and this signal will be derived with R1408-C1404 network and the result will be sent to the Miller integrating network composed with T1403 and T1404. On T1404 emitter can be found, consequently, an horizontal frequency saw-tooth waveform in fase with normal flyback; this signal is applied to the inverting input of CI1401 operational amplifier and can be found inverted and amplified on its output.
The output signal, pin 1, with 8 V p.p. amplitude will be sent to P1403 - P1407 potentiometers, to one input of the integrated modulator CI1406 and to the inverting input of operational amplifier CI1401 where it will be inverted and amplified.
The output of this second operational amplifier (CI1401 with gain 1), pin 7, is still a saw-tooth waveform but with opposite fase respect to the one present on pin 1 and this signal will be sent to the opposite side of P1403-P1407 trimmers, to the second modulator CI1405 and to the two operational circuits of CI1402; the first section of this IC is working as an integrator and the second one as an inverter.
The two horizontal frequency parabole signals obtained in this way with CI1402 are sent to P1408-P1412 trimmers.
On pin 1 of FC connector can be found a saw-tooth, vertical frequency coming from BS950 main chassis, with 1 V p.p. amplitude and this signal is sent to T1401 where it is amplified and applied to the emitter-follower T1402.
The saw-tooth with vertical frequency signal on the emitter of T1402, 3 V p.p. amplitude, is a.c. coupled with C1403 to the inverting input of operational amplifier pin 2 and will be worked-out in the same way as the already explained horizontal saw-tooth signals by means of operational amplifier CI1403 and CI1404.
The two saw-tooth and the two parabole signals, at vertical frequency and with opposite fase, are sent to P1413- P1418 and to P1419-P1423 trimmers and to the two modulators CI1405 -CI1406 to obtain composite waveform.
CI1405 and Cl1406 are working as modulators generating complexes waveform (horizontal frequency saw-tooth signal modulated with vertical frequency parabole signal in CI1405 and vertical frequency saw-tooth signal modulated with horizontal frequency saw-tooth signal in CI1406).
The output signal from CI1405, pin 6, is a.c. coupled to CI1409 amplifier and its output, pin 1 12 V p.p., is sent to P1424- P1426 trimmers and to the inverting input of the second operational amplifier inside CI1409.
The output of this second amplifier (pin 7), same amplitude but with reverse fase, is sent to the other side of the ad-

justing potentiometers.
The output of the second modulator (CI1406) will be worked-out in the same way and the resulting signals from CI1410 will be sent to P1427-P1431 trimmers; the output will be sent, also, to the operational amplifier CI1411 that will amplify and invert the waveform and, due to the insertion in the circuit of C1436 condenser, will produce a Butterfly effect on the signal (see waveform 15 and 16 on the schematic diagram). This signals allows asimmetric correction respect to the two main axes of the picture and is sent to the adjusting potentiometers P1432-P1435.
All the adjusted signals, seven in total with both polarity, are going to P1403-1435 trimmers and the resulting voltages on the slider are mixed and forworded to BS819 convergence output module via RF connector.
With P1436-1441 potentiometers it is possible to send to the output convergence module a c.c. voltage, positive or negative, that is used to shift, in indipendent way, the three immages, vertically and horizontaly, to help when making convergence adjustment.
To one side of the convergence adjusting potentiometers is applied the waveform coming from the circuits already explained and on the other side the same waveform with reverse polarity; in the center can be found the point 0 V c.c. and 0 V a.c.
Moving the potentiometer in one direction, the slider will take off the waveform in a raising way and moving the slider in the other direction the waveform will be reverse and so will be the correction; in the center position, recognizable as a click position, no adjustment will be introduced.
Looking to the schematic diagram can be noticed that the P1407-P1418-P1423-P1426-P1431-P1435 potentiometers are marked with a "M" mark (Master) and this is depending on the fact that this trimmers are acting simultaneosly on the three convergence coils or, in other words, are making overall geometrical corrections as indicated with proper simbols on schematic diagram and printed, also, on the videoprojector push-button unit.
P1413, as can be seen on the schematic diagram, is not working on convergence coils but a.c. is connected (applying vertical saw-tooth) to one side of R358 of the BS950 main chassis, or to pin 7 of CI351 (TDA4950).
This integrated circuit works on the diode modulator of the horizontal output stage on BS950 chassis making skew correction on horizontal deflection current.
In this way the set works with two skew correction; the first one on the horizontal deflection current by means of P1413 potentiometer and the second one on the horizontal

convergence coils of the picture tubes with P1431 trimmer. The correction obtained with P1413 described is necessary to allow tilting of the videoprojector till + or - 20 degree respect to the screen and, in the same time, keeping the output power of the convergence output amplifier in logical values.
Keeping in mind the above description, the skew correction, during videoprojector installation, must be done first with P1413 and, subsequently, if necessary, with P1431.
On the convergence module is inserted, also, the circuit generating the waveform used to obtain corner correction; this circuit is made up with integrated circuits CI1412-CI1413-Cl1414 and CI1415, the related components and, see schematic diagram, P1442 and P1458 potentiometers used to adjust corner correction signals going to convergence output amplifiers.
On one side of P1446 is applied, via R1549, a vertical saw-tooth signal and, in the same moment, on one side of P1455 is applied, via R1565, the same signal with 180 degree phase shift; the other two sides of P1446 and P1455 are connected, via R1551 and R1563, with a "butterfly" signal.
On the center tap of the potentiometers will be present the combination of the signal that will be applied to two combination of diodes D1401-D1402 and D1403-1404 that will let pass in one direction the signal positive components and in the other direction the negative ones. P1446 and P1455 are used to to adjust in a good balanced way the positive and negative components.
DZ1403-DZ1406 zener diodes will allow only part of the signals to reach the operational inputs and, specifically, only 20 usec signals (about 1/3 of line period); these signals are amplified, and phase reversed, by operational amplifiers CI1472-CI1415 and applied to the adjusting potentiometers. Subsequently these signals are added to others convergence signals by means of R1572-R1587 resistors.
It is possible, in this way, to obtain on RF connector all convergence signals that will be applied to the power output amplifiers mounted on BS819 convergence and out-put module.
On BS813 convergence adjustment module is mounted, also, teh circuit that is generating the test signal (cross-hatch generator) used to execute convergence during videoprojector installation.
The circuit is composed with integrated circuit CI1416 (ZNA 234) and the two transistors T1407 and T1408; on the output AS1., will be present a composite video signal with negative sync, 0,8 V p.p. amplitude, that will be sent on pin 20 of SCART socket 2 mounted on audio module.

CI1416 is supplied via a two way switch (DV1404), that is supplying, also, two lamps that are lighting, during adjustment, the trimmer area of the control panel.
To execute electrical convergence it is necessary to perform the following operation:
- Switch on the videoprojector.
- Push two times n.0 push-button till the writing "PAZ" will be shown on the display.
- Switch ON DV1404; CI1416 will be supplied and, in the same time, the two lamps will be lighted helping the adjustment in dark surroundings. On the screen will be displayed the cross-hatch.

BS819 CONVERGENCE OUTPUT MODULE

On this module are mounted the three circuits that are receiving the complex waveform coming from the convergence adjustment module. The connectors of this module are:

Module Inputs/Outputs		Coming from/Going to
RF1 RF2 RF3 RF4 RF5 RF6 RF7	Signal combinations needed for convergence adjustment.	From BS813 convergence
PC1	Ground.	From BS820 supply module.
PC2	- 15 V c.c.	
PC3	+ 15 V c.c.	
YCR 1....4 YCG 1....4 YCB 1....4		To the three picture convergence coils.

Looking to the schematic diagram, it is possible to see that the signals combination, coming from the convergence adjustment module via RF connector, are going separately on different non-inverting inputs of 6 operational amplifiers.
This amplifiers will amplify the relevant waveform on there inputs (pin3) and the outputs will drive the output power amplifiers.

The output power amplifiers, consisting of NPN transistor TIP 41 A and PNP transistor TIP 42 A, are amplifying the the signals present on pin 6 of the operational amplifiers and driving the relevant convergence coil.
The sistem is working with current control and this can be seen looking to the feedback resistors, from R1017 to R1052, that are reading voltages that are exactly proportional to to the currents flowing in convergence coils; with these voltages it is possible to obtain feedback on the operational amplifiers feeding-back signals to the inverting inputs, pins 2, by means of resistors from R1003 to R1008.
Using this sistem, all current variation depending on coils resistance shift or other problems, are continuosly controlled and the feedback on the operational amplifiers will cancel-out this shifts assuring a very good stability to convergence currents.
Resistors from R1016 to R1051 connected in parallel to the convergence coils, are inserted to damp-out the coils themselves to avoid autooscillations that can produce distortions on the projected images geometry.

BS824 BNC CONNECTORS MODULE

On this module can be found the 9 pin CANNON connector that can accept in its inputs TTL signals coming from a computer, and 5 BNC inputs that can receive analogical R - G - B signals. On the same module is mounted, also, one electronic switch selecting sync signals coming from CANNON socket or from BNC input.
Connections with this module are:

Module Inputs/Outputs		Coming from/Going to
Y'1 Y'2	Positive sync signal or positive composit video video signal.	To BS815 video module.
PR1	Analogical video signal or TTL bleu signal.	To BS815 video module.
PR2	Analogical video signal or TTL green signal.	
PR3	Analogical video signal or TTL red signal.	
PR4	Blanking signal.	
PR5	Ground.	
PR6	+ 5 V c.c. supply.	

As can be seen on the schematic diagram, the three R -G - B signals on pin 3-4-5 of the CANNON socket (PA80) , are sha ped with the three non-inverting amplifiers of CI802 and this signals are applied to three different emitter-follower.
On the base of these emitter-follower the signals are voltage divided with resistor dividers, respectively, R814-R 828, R820-R829 and R824-R830; when the signal INTENSIFY is High level, resistors R828-R829 and R830 are cut-off and, consequently, can be found maximum level of signals on the emitter of transistors T803-T804 and T805.
When the signal INTENSIFY is Low level, instead, the three diodes D801-D802 and D803 will be conducting and the signal on the three transistor base will be reduced, about 30%, and this will permit the display of light greys.
On pins 8 and 9 of CANNON connector there are applied horizontal and vertical sync and these signals are sent to integrated circuit CI801 that is composed of 4 Exclusive OR gate circuits. This circuit is working in this way:

- if the horizontal sync is positive going, the average value of this signal will be Low level and the voltage on integrating components R801-C801 will be, too, Low level; in this case the sync pulse applied on pin 9 will be with the same phase on pin 8 output (positive).
- If the sync pulse, instead, is negative going, the average value will be High level and the voltage on the integrating components will be, too, High level; in this case the sync pulse applied on pin 9 will be phase reversed on pin8 output (positive).

The same considerations applies, also, to vertical sync coming from pin 9 of CANNON connector; with this considerations it is easy to understand that the signal coming out from pin 6 of CI801 will be, always, a vertical sync signal positive going.
These two signals are added on T801 base, by means of resistors R804-R811, and on the collector will be present a negative composite sync signal that will drive T802 transistor, connected in emitter-follower configuration, and on the emitter of this transistor can be found a low impedence negative going composite sync signal.
This signal is applied, via R815, to one side of DV801 switch that is selecting the sync that will be sent, via Y connector, to sync separator of BS815 video module.
On BNC connector module are mounted, also, 5 BNC connectors; three of them, R - G - B, are signal inputs for signal with 0,7 V p.p. maximum amplitude (R - G - B analogical inputs) and in this module they are parallel connected, without any switching, to sync coming from Cannon connector; the signals are sent, via PR connector, to the

Scart 1 socket relevant inputs.

N.B.: from what was described, it is clear that only one of the three inputs, SCART - CANNON - BNC, can be connected and this must be done to avoid interference between different signal sources.

The fourth BNC connector can be connected to negative going sync generators or to analogic composite positive going video signals; in this case the switch selecting the sync must be in the higher position.
The fifth BNC connector, the least one, can receive as its inputs, a blanking pulse, or a partially video blanking pulse that can be used for writing insertion on the picture; in this case it will be necessary to use proper sync generators to syncronize the two signals.

BS787 PUSH-BUTTON MODULE

The push-button module BS787 is made-up with two parts; on the first one can be found the mains connection, the headphone amplifier (CI51) and the infrared (IR) remote control front receiver. On the other part can be found the remote control rear receiver, six push-button for local controls, the circuits for the three displays and BS764 module supporting the three displays. The two half modules are interconnected with B'1-B'5 connectors.

Module Inputs/Outputs		Coming from/Going to
I	220 V a.c.	
I	220 V a.c.	
A'1	+ 12 V c.c.	From BS761 audio module.
A'2	Ground.	
A'3	Audio headphone input.	
VR'1	+ 5 V c.c.	From BS797 frontal preamplifier module.
VR'2	Ground.	
VR'3	IR signal.	
VR'4	Ground.	
KB1		Different signals coming from BS815 video module.
.		
.		
KB20		

The headphone amplifier, receiving on its input the audio signal coming from BS761 audio module, wil amplify the signal to the level necessary to drive the headphone set normally used in HI-FI sistems.
By means of P51 potentiometer, mounted on the pushbutton unit, will be possible to adjust audio level; it is, also, possible to connect a third Infrared remote control Receiver by means of a three way connection cable.
On the second part of the module can be found the Infrared remote control receiver comprising FD41 and FD 42 diodes and CI41 integrated circuit.
The Infrared pulses coming from Remote control transmitter, that must be pointing to the pushbutton unit, will be detected by the two photodiodes and will be amplified by TBA2800 IC's (CI41); the output of this IC (pin 8), will be one signal with 5 V p.p. amplitude and this signal will be current amplified with T41 transistor (this is necessary to permit parallel connection of different Infrared amplifiers without signal losses).
On this second part of the module are mounted, also, the driving circuits for the three displays (see schematic diagram), and six pushbutton permitting emergency utilization of the set if the remote control is not working.

BS797 FRONTAL INFRARED REMOTE CONTROL PREAMPLIFIER

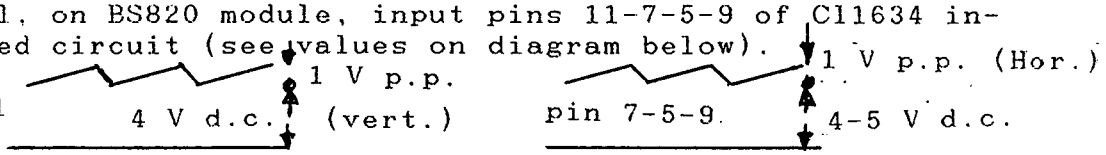
On this module, mounted on the front part of the videoprojector, is mounted one circuit equal to the one already described. To command the videoprojector by means of this remote control receiver, it is necessary to direct the remote control on the screen; in this way the Infrared pulses will be reflected by the screen directly inside the remote control receiver mounted on the videoprojector front.
The two remote control receivers are, naturally, parallel connected and is possible, in this way, to command the videoprojector, from front or rear, indifferently.
As already said, it is possible to connect a third remote control by means of a three way cable (for instance telephon cable) with the purpose of remote control of the videoprojector with cables as long as 100-150 mt. without the use of line amplifier. This can be useful when the videoprjector is used, for instance, for conference or recreational rooms.

FAULT-FINDING PROCEDURE

When the videoprojector is faulty in some circuits, it is going in protection condition and is going, automatically, in stand-by condition; the set will be returning automatically in protection condition if the operator will try to switch-on again the videoprojector.
To help in fault-finding in these conditions, the following procedure can be used to disable the protection circuits.
When the videoprojector is switched on and goes back to stand-by condition, observe the LED (DL1601) on BS820 module; if the LED is lighted the fault can be on the modules:
- Deflections.
- EHT.
- Vertical.

Check G1 voltages for:
. - 150 V (this voltage will cut-off CRT's beam currents avoiding phosphourus burnings); this voltage can be measured on pin 1 of ED connector.

Disconnect R1250A (100 ohm) from BS776 module; if DL1601 is still lighted this operation will take-off reset from digital video module.
Switch on again the set and check if the driver signal will be reaching the BU508 transistor of BS950 main chassis; if the signal is not present check the digital module, the line driver transistor and the BU508 itself.
If the signal is normal, check the vertical stage and, eventually, repair the module.
If vertical deflection is normal, it will be necessary to control dflection coils.
Control, on BS820 module, input pins 11-7-5-9 of CI1634 integrated circuit (see values on diagram below).



If, instead, diode DL1601 will be cut-off disconnecting R1250 of BS776 module, the three G1 grids will be at +8 V (- 150 V on the preceding example); in this case the picture will be larger than normal , this means lower EHT voltage, and, consequently, CI1231 reset (pins 14-1-2) is giving protection to EHT. Reset is, in this case, at aproximately 0 V instead of high value like in normal cases and this low value is taking to ground C 1242 via diodes D1239 and R1288.
This appens because one of CI1231 comparators will be on; in this case control if one of the reference inputs is around 0,9 V d.c.

If the reference inputs are at normal values control:
- pin 5 must be >1,5 V d.c.; if the value is lower check the beam current limiter circuit.
- pin 6 must be < 0,9 V d.c. (0,7 V c.c. normal); if the value is higher control the preceding circuits.
- pin 9 must be >0,9 V d.c.. If the value is lower DL1601 must be lighted; check, in this case, the diode itself and the relevant circuit.
- the last comparator is connected, via C 1259, to the ON/OFF line; this line is giving to pin 10 one pulse, raising pin 13, that consequently will rise pin 9 to + 15 V d.c., via D1238 diode, avoiding that the sistem will enter protection condition due to deflection absence during switch-on of the set.

If this comparator is in faulty condition it is pratically impossible to switch-on the videoprojector, also if the reset is not working, and to control this condition it will be necessary to rise pin 9 voltage connecting the pin itself to + 15 V d.c. with 10 Kohm resistor.
In normal working condition CI1231 (on BS776 module) can be found the following voltages:
- 0,7 V d.c. on pin 6 (P1235).
- 1,6 V d.c. on pin 5 with white pattern (P1231).
- 1,8-1,9 V d.c. on pin 5 with normal test pattern.

After service operation on EHT circuits check, switching On and Off several times the set, that the EHT will rise slowly during switch On.
If the EHT voltage will rise in a fast way, check if the variable resistor, made-up with T1233 (BU426) mounted on BS776 module, is short-circuited (partially or totally) and if the control network is working properly.

Attention : To execute repairs on convergence module it is recommended to use an external d.c. power supply (+ 15 and - 15 V d.c.).

VIDEOPROJECTOR WITH BS950 CHASSIS SERVICE ADJUSTMENT

With videoprojector switched on, short-circuit S2 bridge on digital video module and, at the same time, push the P/C pushbutton of the remote control. The videoprojector is, now, in "Service" condition; remove the short-circuit to allow memorization of subsequent adjustment:

< / > Decrement/Increment of adjustment steps.

+ / - Increment/Decrement of adjustment amount.

>•< Memorization of last adjustment.

ADJUSTMENT SEQUENCE

P - - Service condition for the videoprojector.

P5P Do not adjust.

P6P Do not adjust.

P40 Adjust with test pattern signal; adjust P4 (convergence module) to extreme position till the picture is distorted on screen side. Adjust with remote control till the distortion is symmetrical on both side of the screen (and equal at top and bottom of the picture tube). This adjustment must be done, also, for 60 Hz using, for instance, 60 Hz from R-G-B Personal Computer signal (it is necessary to switch the projector, first to 60 Hz and, afterwards, to switch the sistem in Service condition).

Pt0=
Pta=
PP0=
PPa= } Do not adjust.

Pt1=
Pt1=
PP1=
PP1= } Do not adjust.

PAD / PHo — This adjustment must be done with the videoprojector in horizontal position and with the screen centered with the projector horizontal axes. Adjust for good amplitude and vertical shift; this adjustment must be done, also, for 60 Hz using a 60 Hz R-G-B signal coming from a Personal Computer (first switch the videoprojector to 60 Hz and, afterwards, switch the sistem in Service condition).

PHD — Do not adjust.

P5D= / P5o= — Do not adjust.

P5I= / P5,= — Do not adjust.

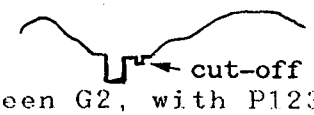
PUd — Do not adjust.

PLd / P Dd — Luminance and crominance phase. This adjustment must be made only when changing SECO 19 with with SECO 21B microprocessor (insertion of PIP module). This indications are present only on Quadristandard projector or PAL/SECAM projector with PIP feature already inserted.
These adaption will be not need adjustment in Quadristandard projector but will be needed only when changing SECO 19 with SECO 21B microprocessor (adaption already described in the PIP 90 instruction boocklet.

Do not adjust.

P5A — Clock adjustment to link the 4,43 MHz oscillator.

P62 — Adjust P1232-P1233-P1234 on the BS776 module in complete anticlockwise direction (start of the adjustment.
Adjust cut-off green cathode, with P1101 on the BS840 module, for 140 V d.c. (measure with oscilloscope).



Adjust green G2, with P1233, to the intermediate position of the trimmer between digital points cut-off and audio coming on.
Adjust red G2, with P1232, in clockwise direction, till digital point of the third digit will be lighting-up and, then, turn in the other direction till

digital point will be cut-off.
Adjust bleu G2, with P1234, in clockwise direction till digital point of the third digit will be ligh-ing-up and, then, turn in the other direction till digital point will be cut-off.
Control Cr-Cg-Cb function; Cg only must have digital point alighted. If is not so, repeat the three G2 adjusting procedure.

Pcr Adjust with small steps for correct white level at low brightness.

PcG Do not adjust.

Pcb Adjust with small steps for correct white level at low brightness.

Pdr
PdG
Pdb In one of these three position adjust high brightness white level:
- adjust to maximum brightness and contrast
- adjust P1190 (in clockwise direction) of the three CRT video output modules.
- adjust red and blue trimmers (do not move the green one) to obtain the best possible white. Do not move excessively the two trimmers to avoid more than 15 V p.p. between the cathode of the two picture tube in respect to the green video signal.

Attention: do not adjust these function by means of remote control; if the adjustment will be performed in this way and memorized, the memory must be changed.

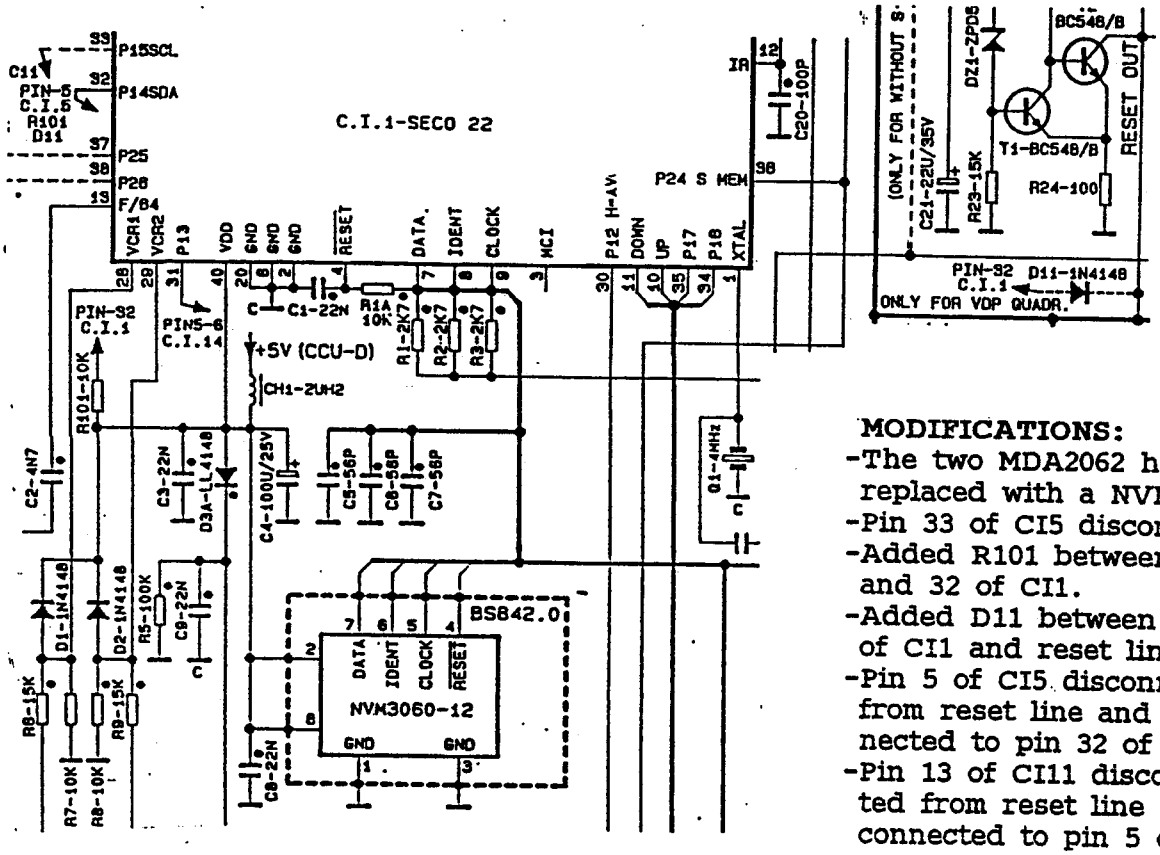
OPTION BITES FOR QUADRISTANDARD VIDEOPROJECTOR

Option bite 1	EUROPE	P_0	UK	P_8.
	MONITOR	P_8	UK MONITOR	P_C.
Option bite 2		P=8.	Do not adjust.	
Option bite 3	NO PIP	P=8	WITH PIP	P=9.

OPTION BITE FOR PAL/SECAM VIDEOPROJECTOR

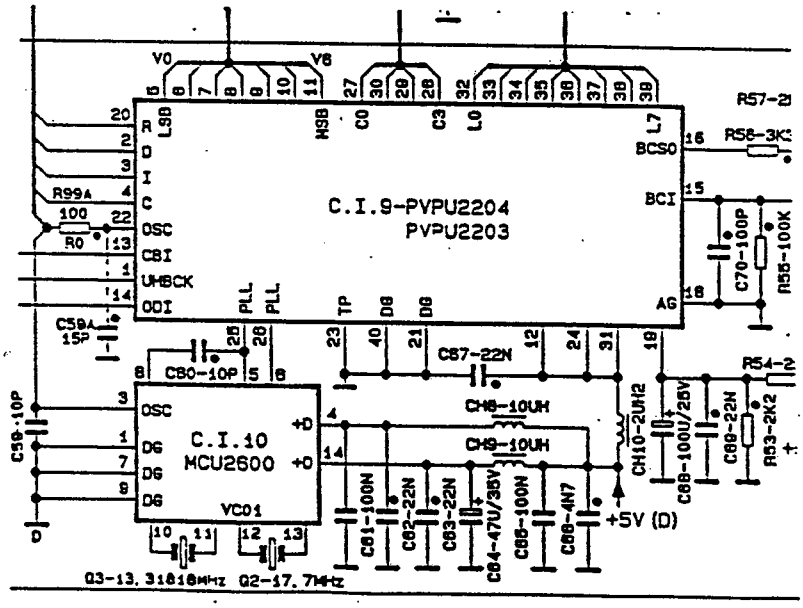
Option bite 1	EUROPE	P_2	UK	P_C.
Option bite 2		P=3.	Do not adjust.	
Option bite 3	NO PIP	P=8	WITH PIP	P=9.

VARIATIONS FOR QUADRISTANDARD VIDEO MODULE



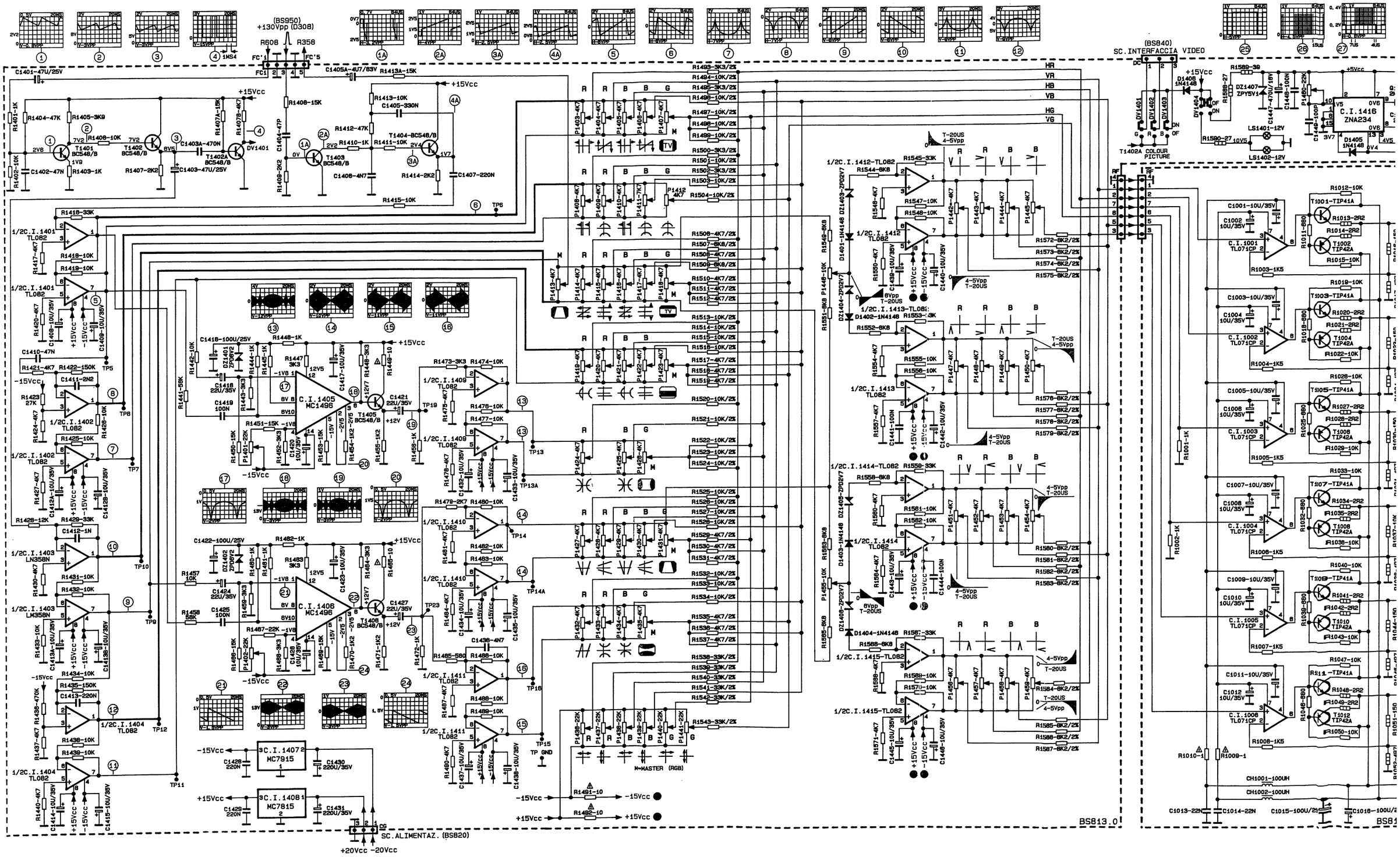
MODIFICATIONS:

- -The two MDA2062 have been replaced with a NVM3060.
- -Pin 33 of CI5 disconnected
- -Added R101 between pin 40 and 32 of CI1.
- -Added D11 between pin 32 of CI1 and reset line
- -Pin 5 of CI5 disconnected from reset line and connected to pin 32 of CI1
- -Pin 13 of CI11 disconnected from reset line and connected to pin 5 of CI5

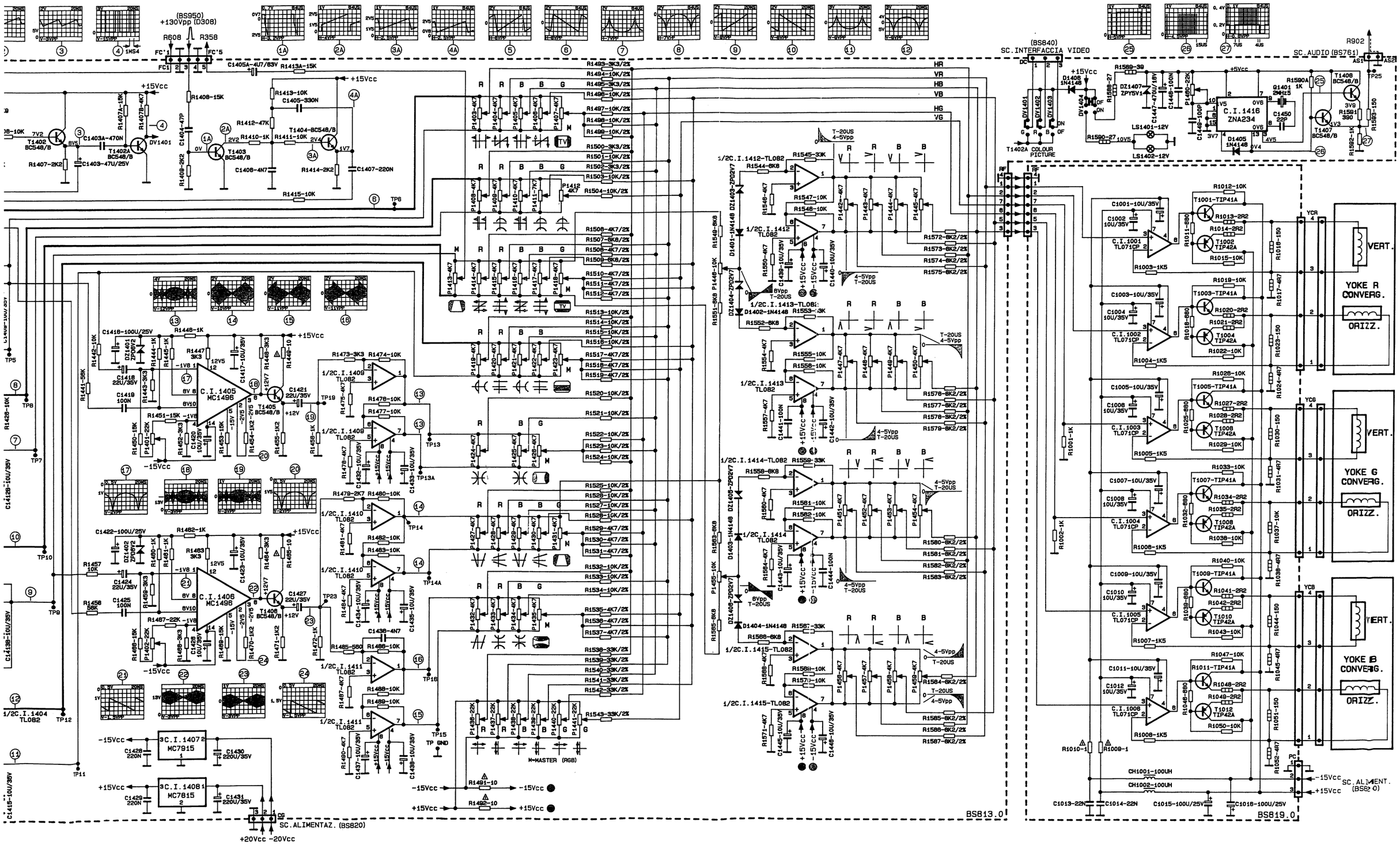


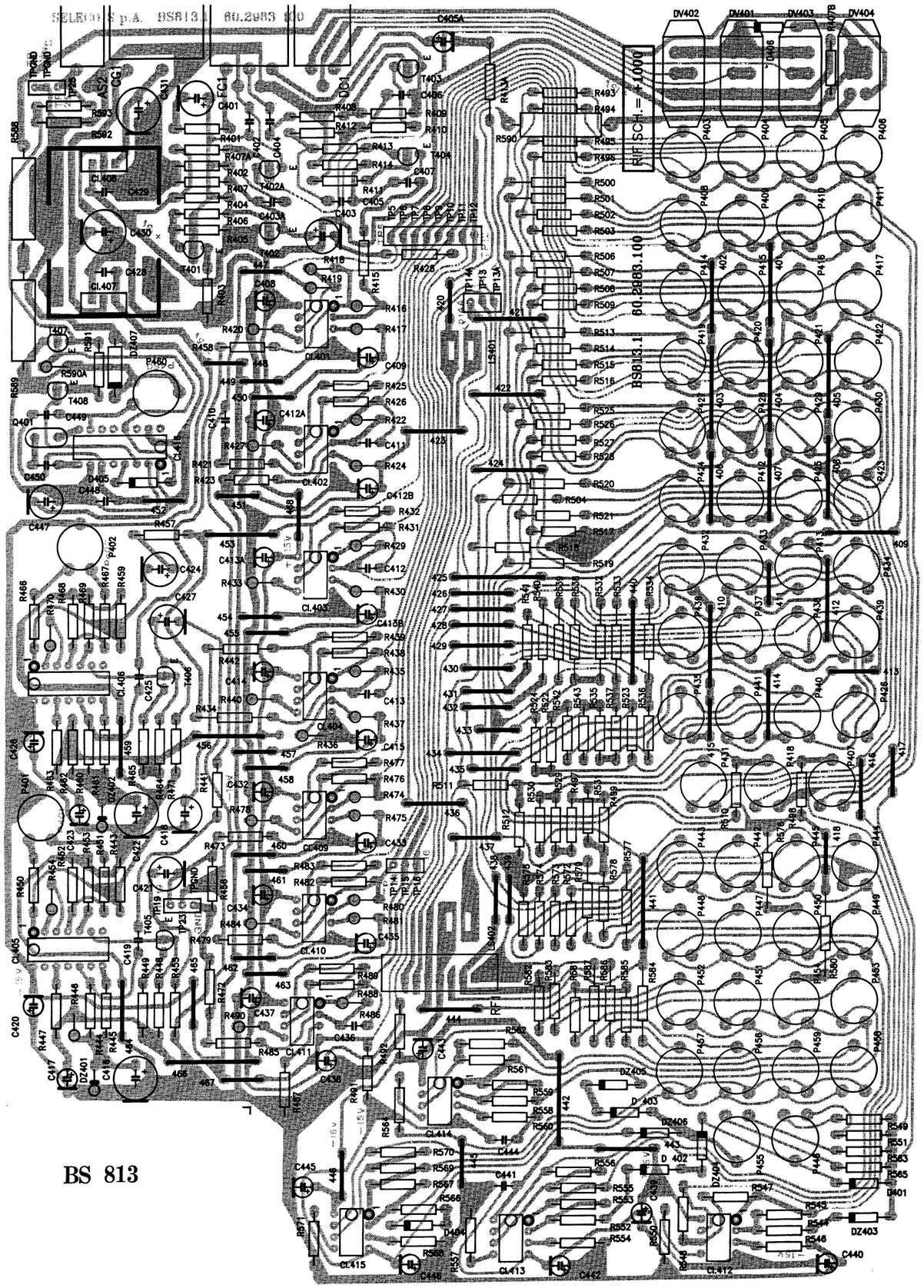
A 13.31 MHz quartz has been added to pins 10-11 of the MCU2600.

SC. REGOLAZIONE + FINALI CONVERGENZA



GOLAZIONE + FINALI CONVERGENZA

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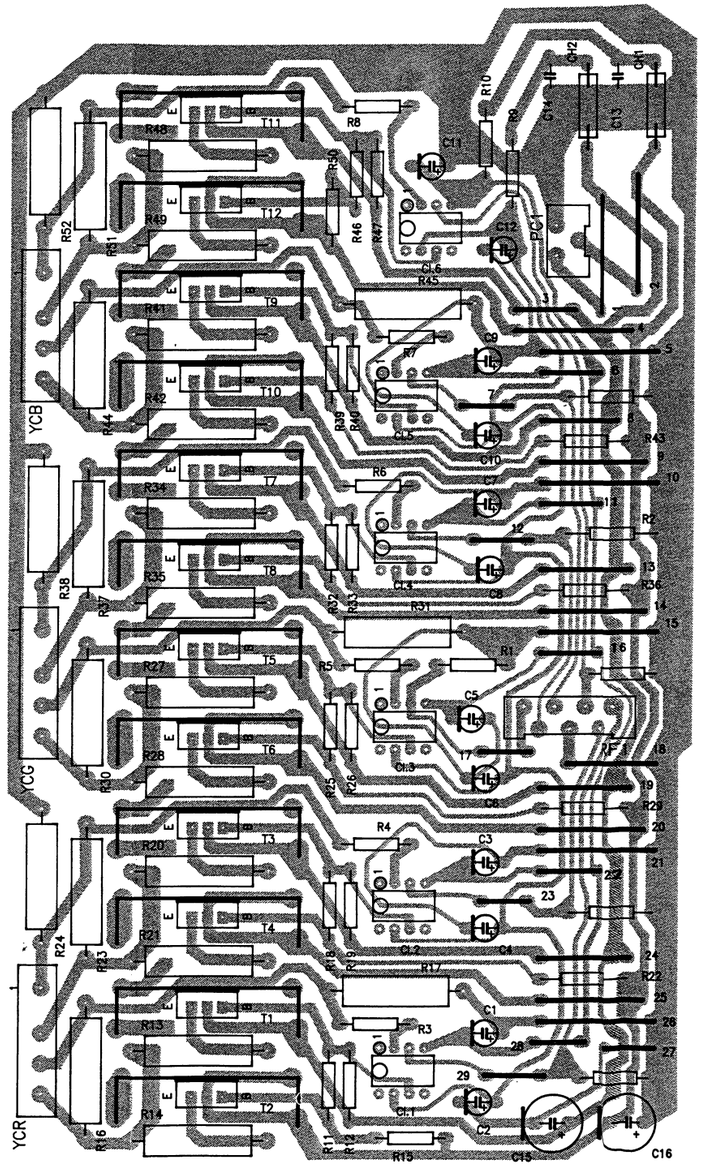
BS 813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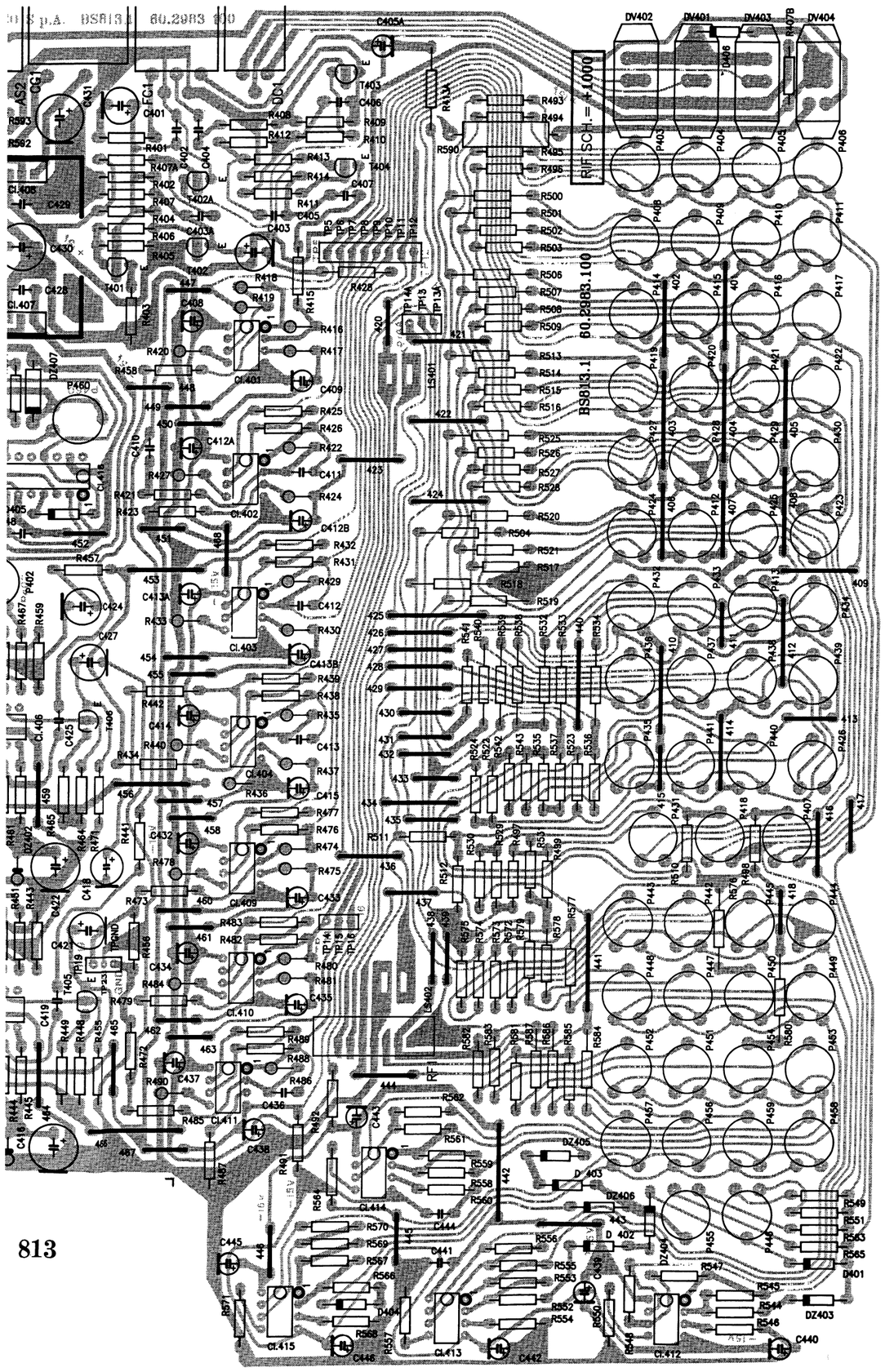
BS 819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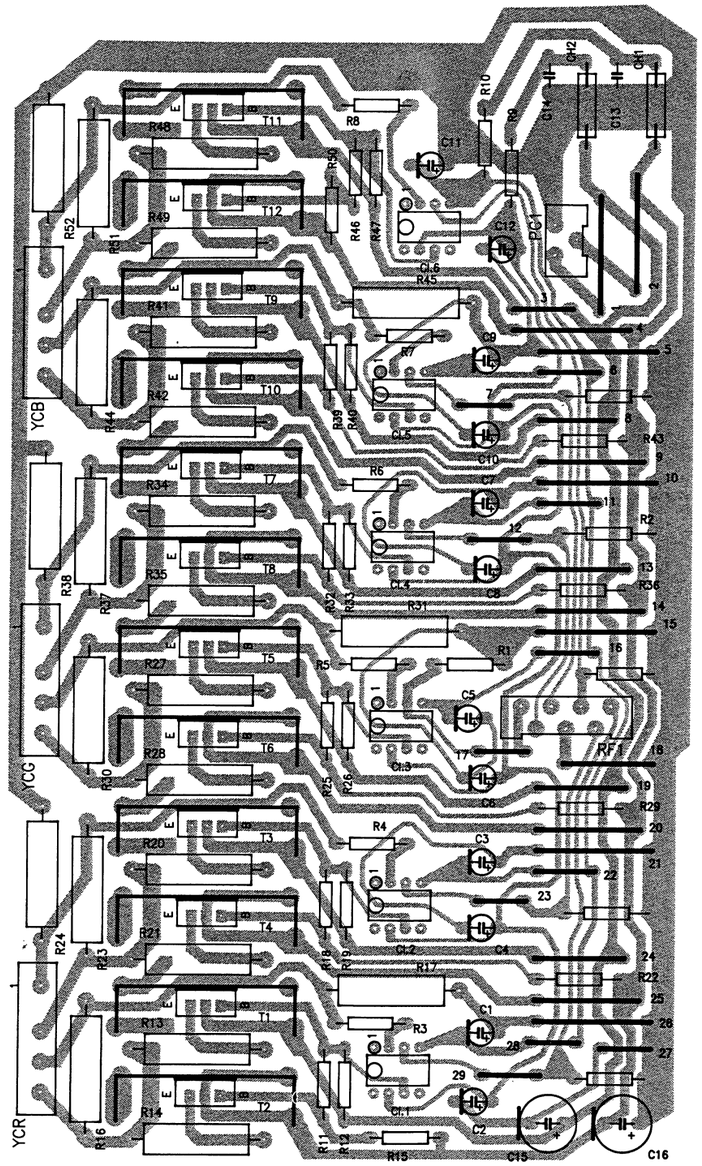
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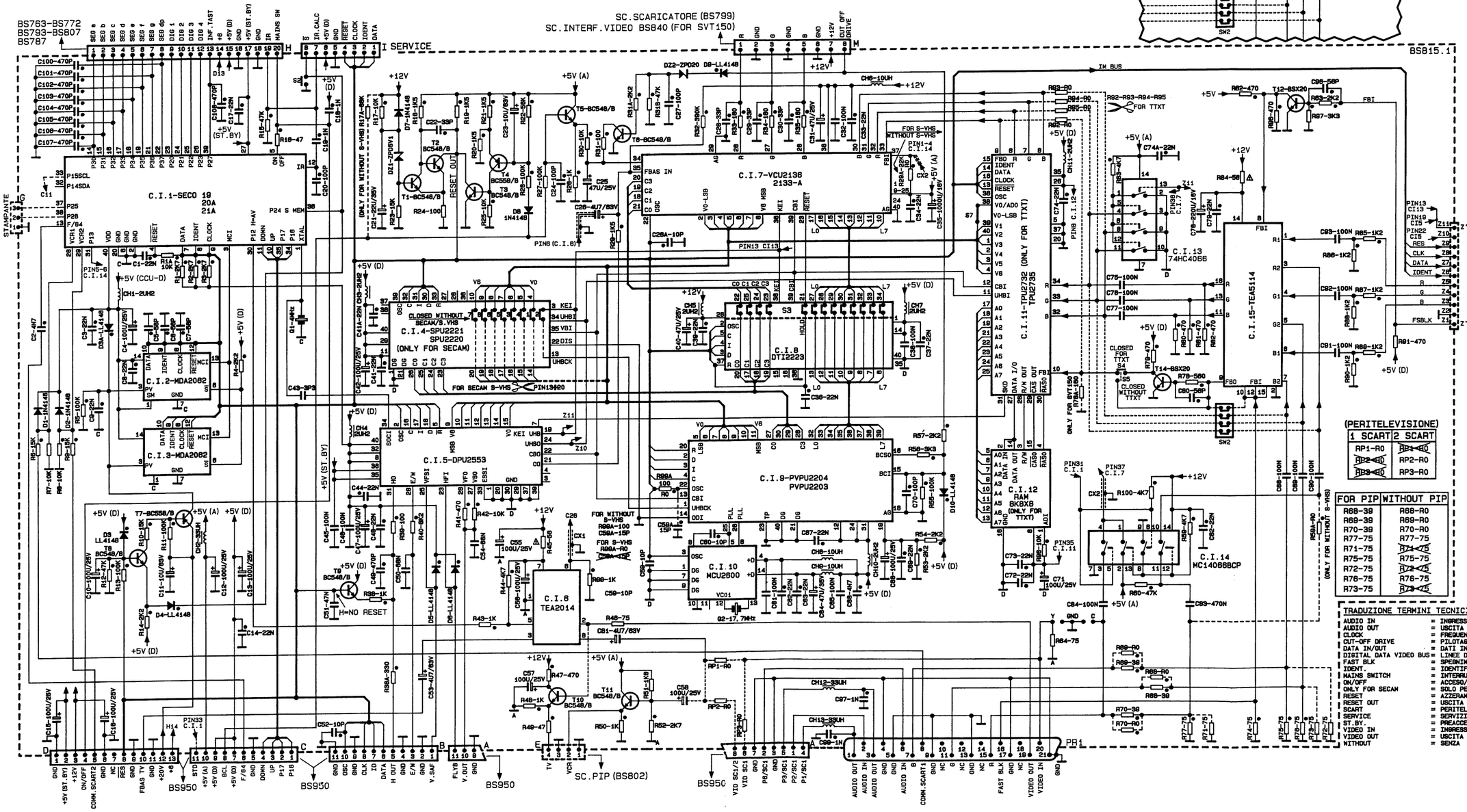
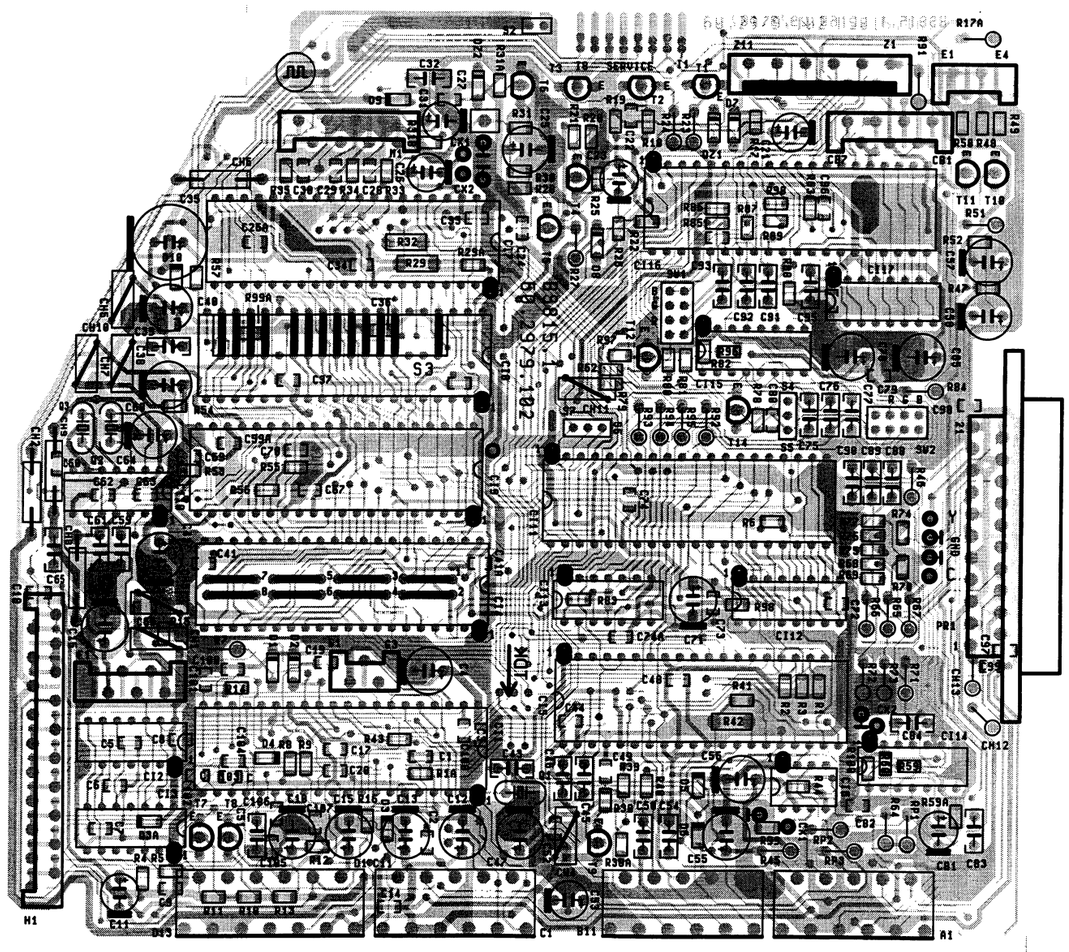
BS 819

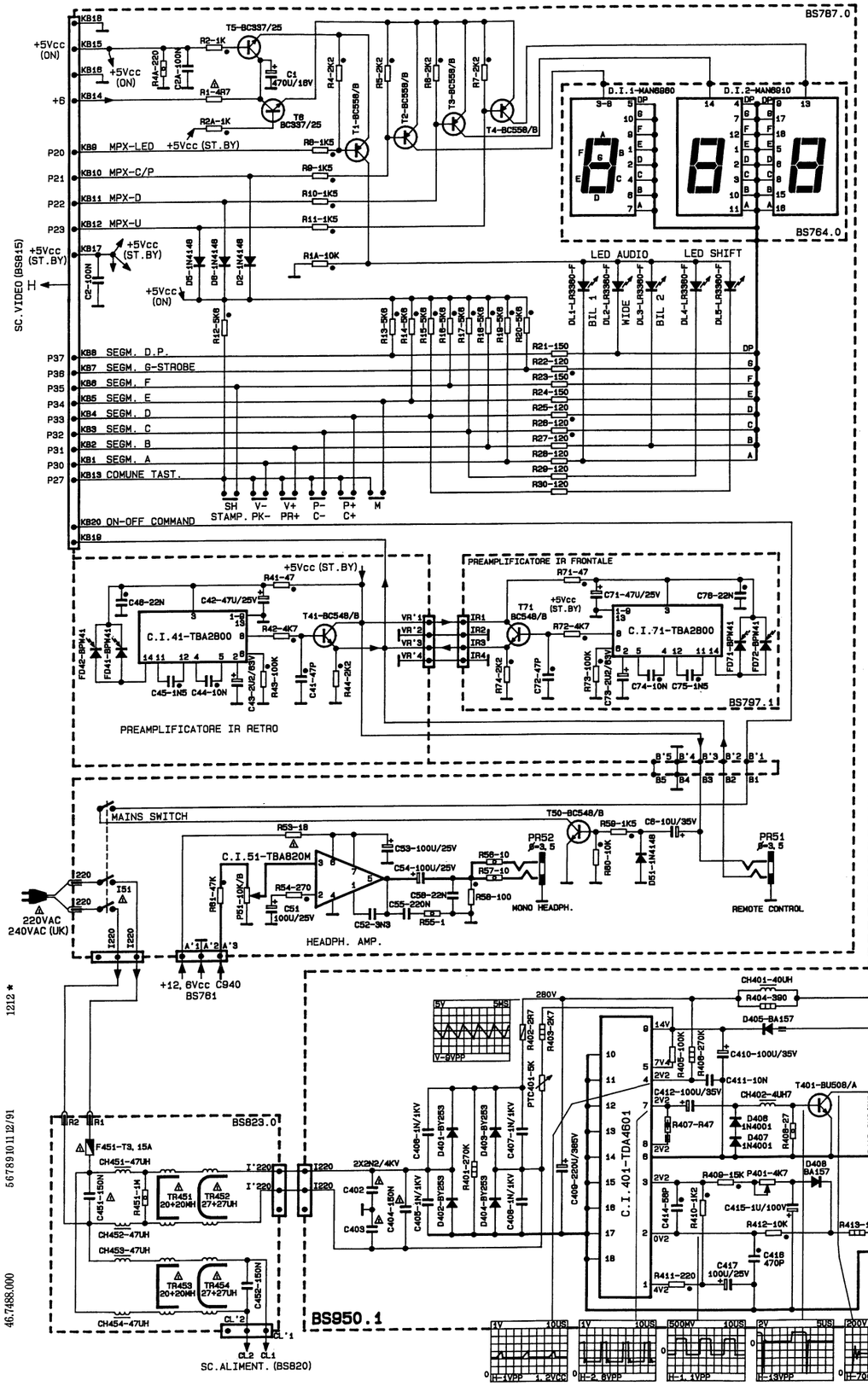
SC. VIDEO TOP S-VHS



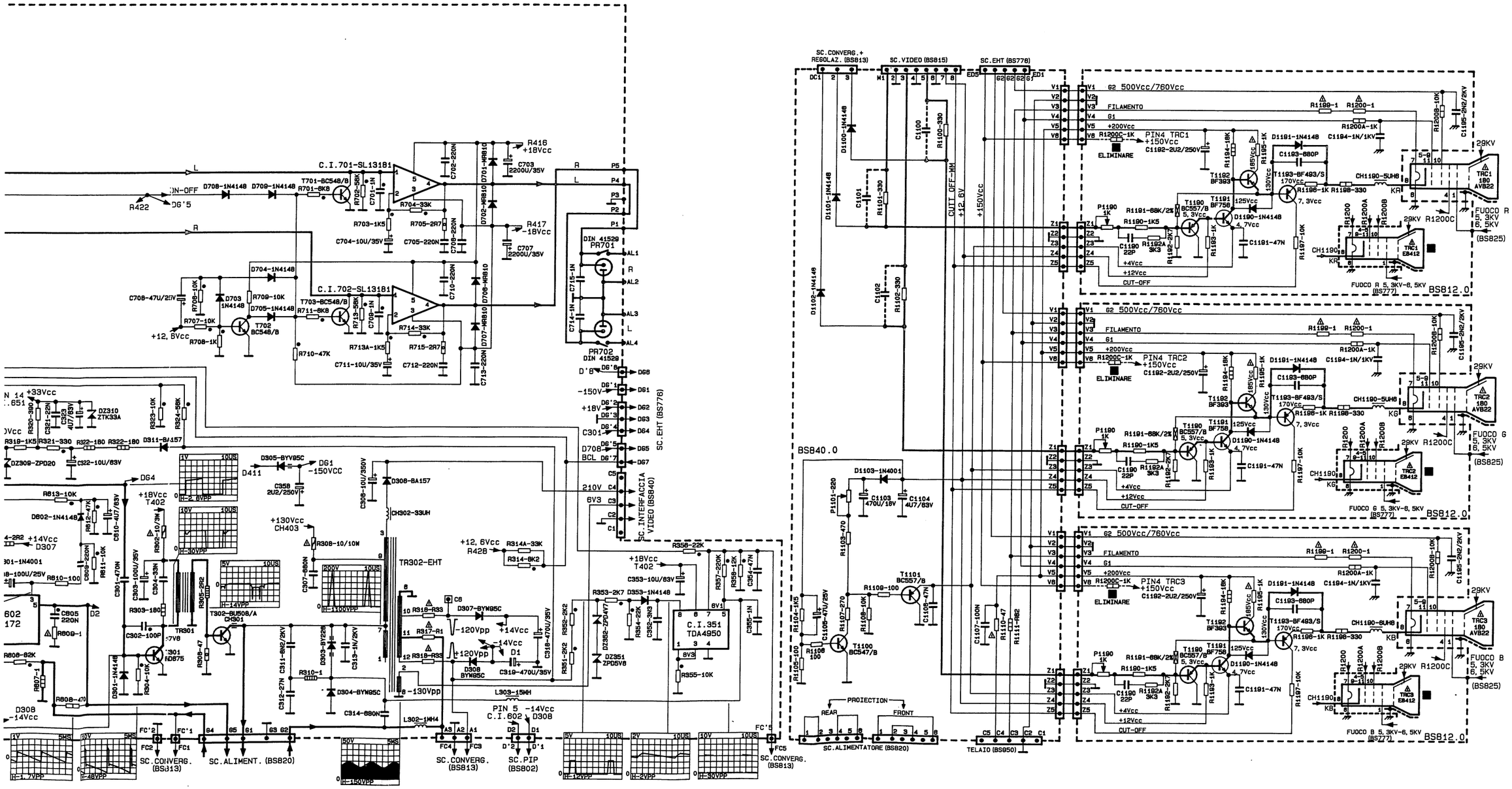


BS 815

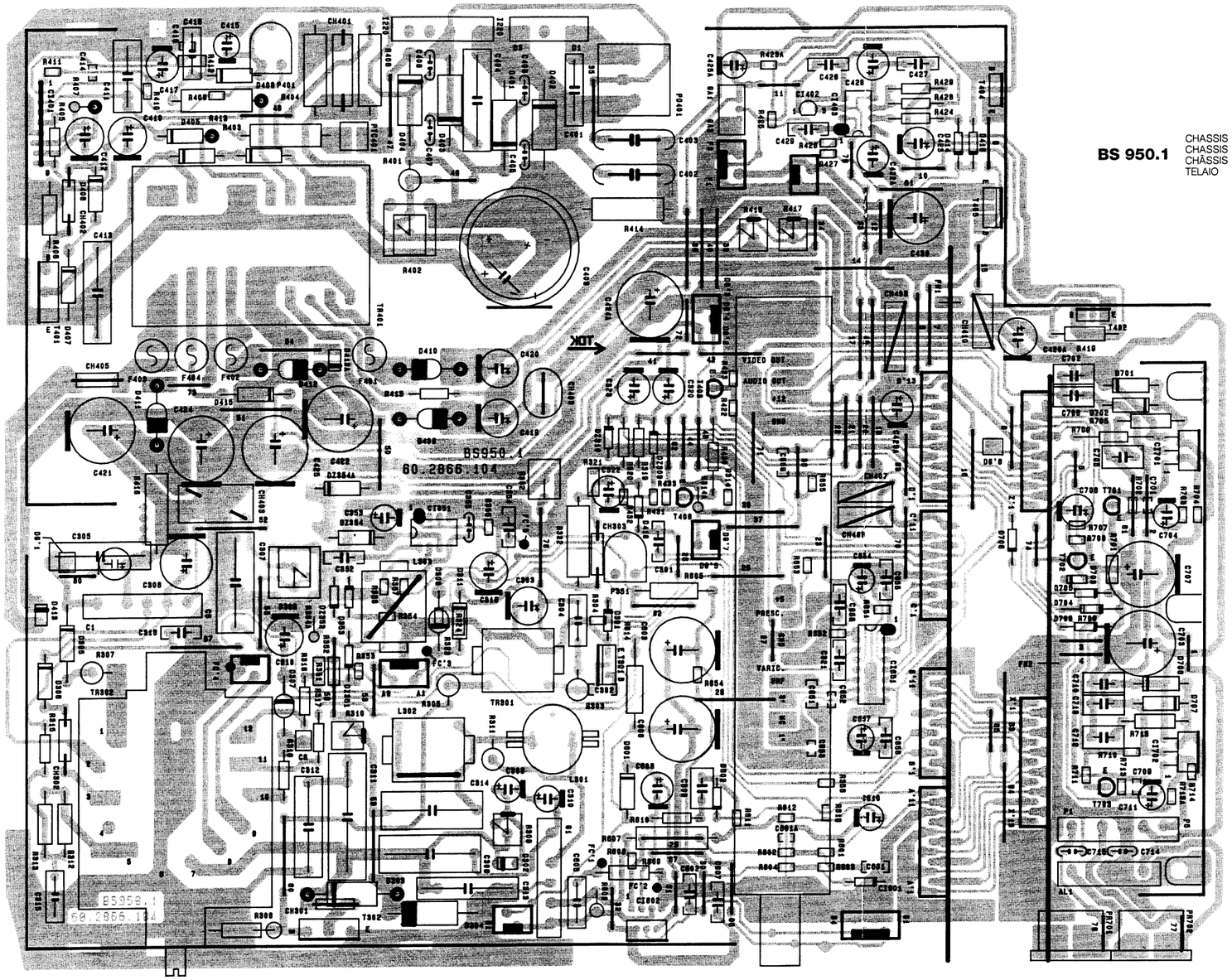
TELAIO - FRONTALE - FI

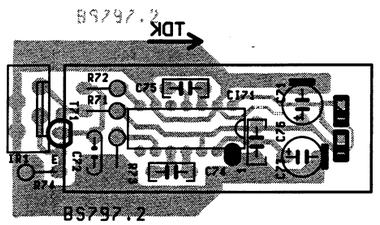


FRONTALE - FILTRI - INTERF. VIDEO - FINALI VIDEO

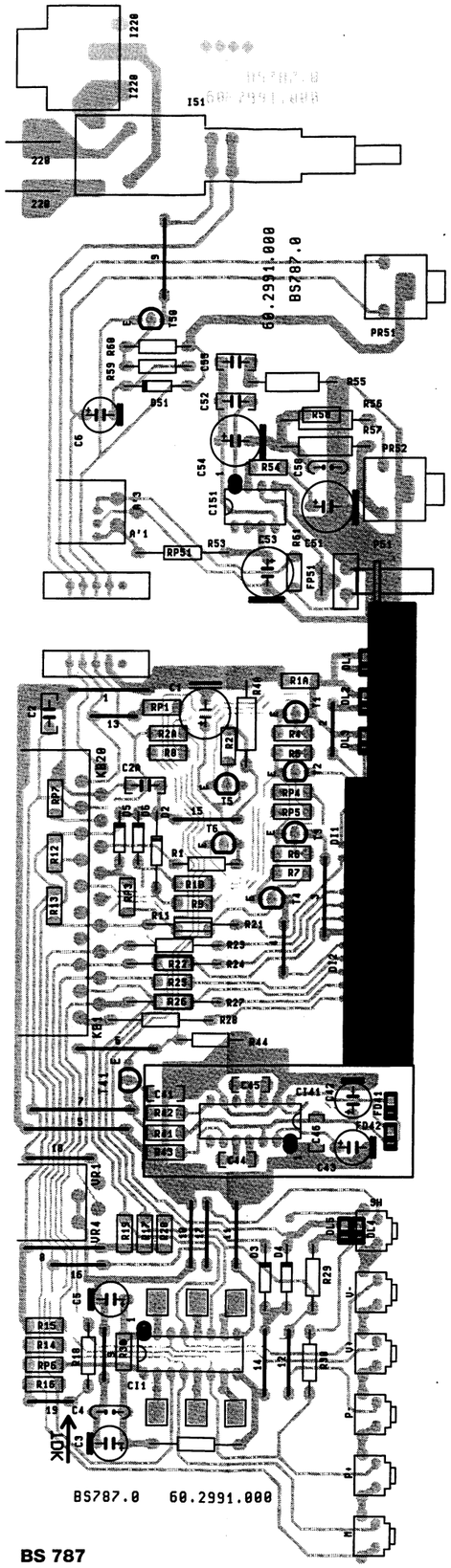


BS 950.1 CHASSIS / CHASSIS / CHÂSSIS / TELAIO

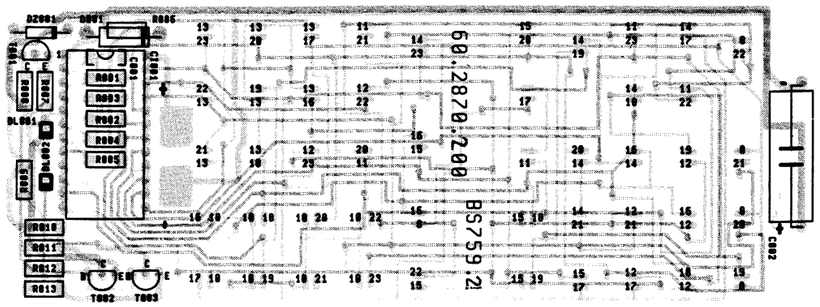




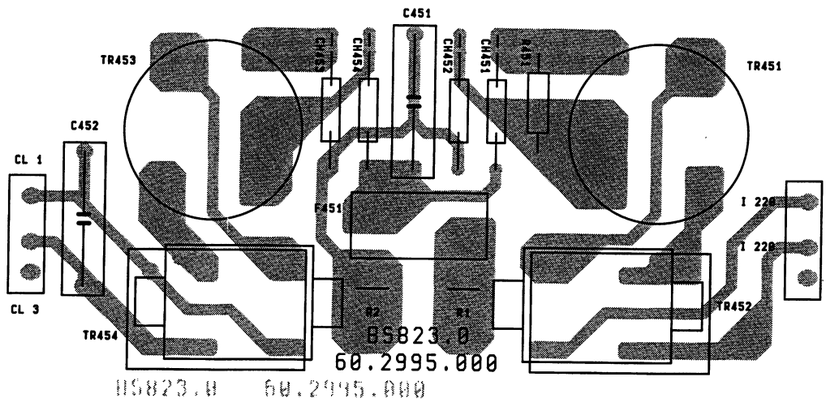
BS 797



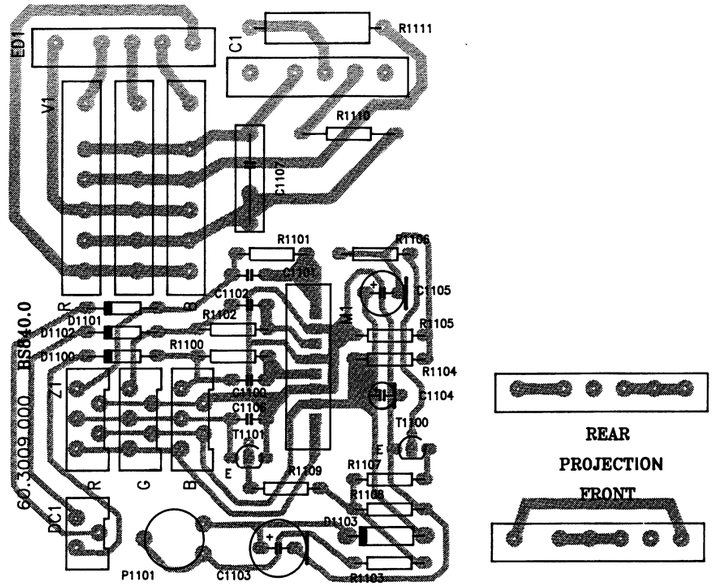
BS 787



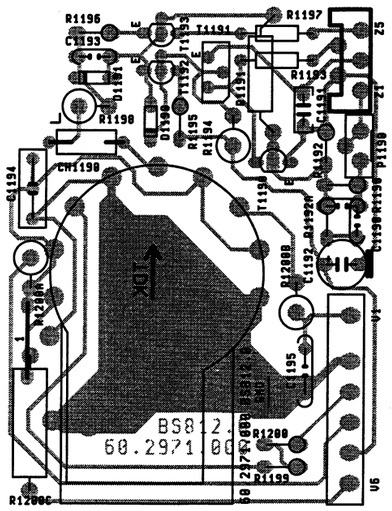
BS 759



BS 823

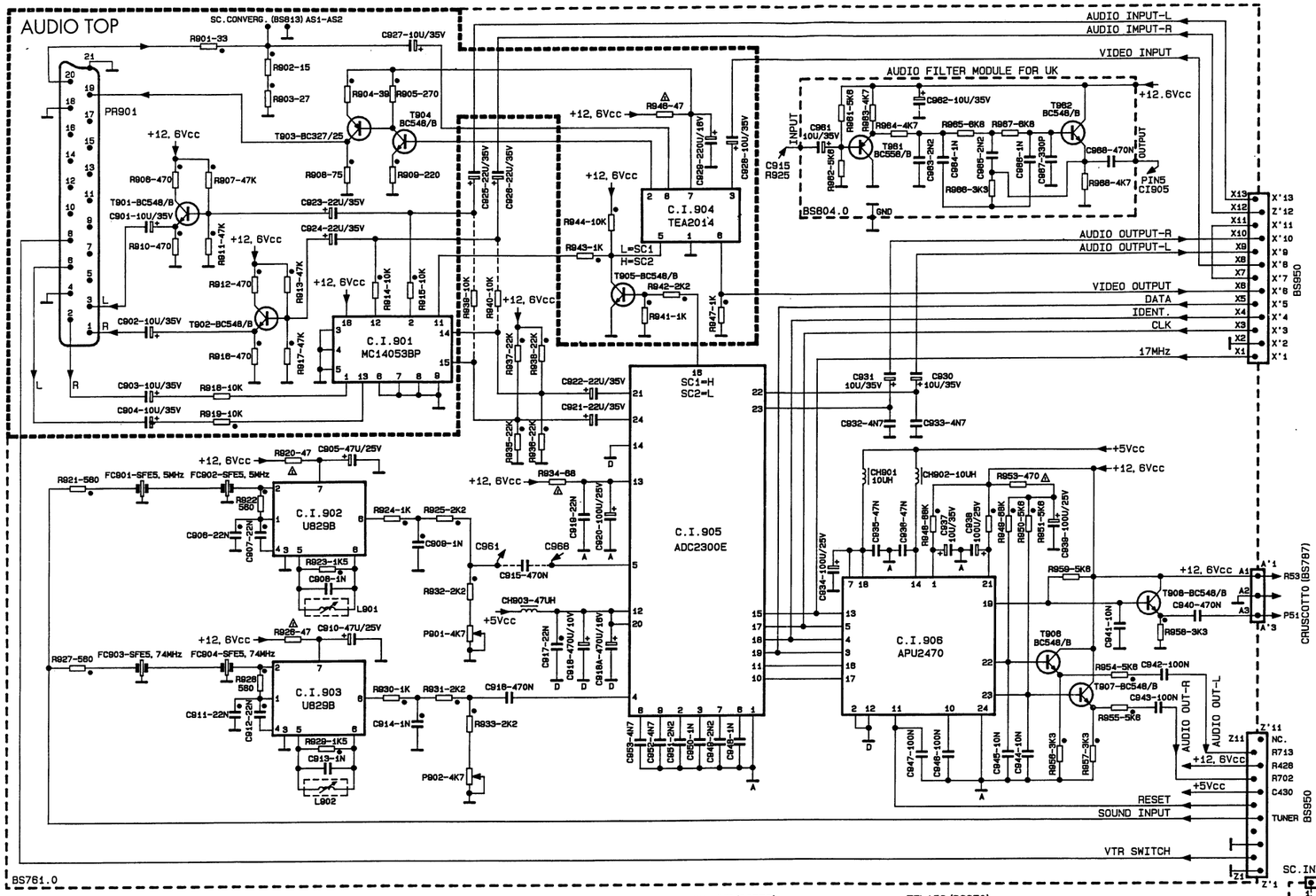


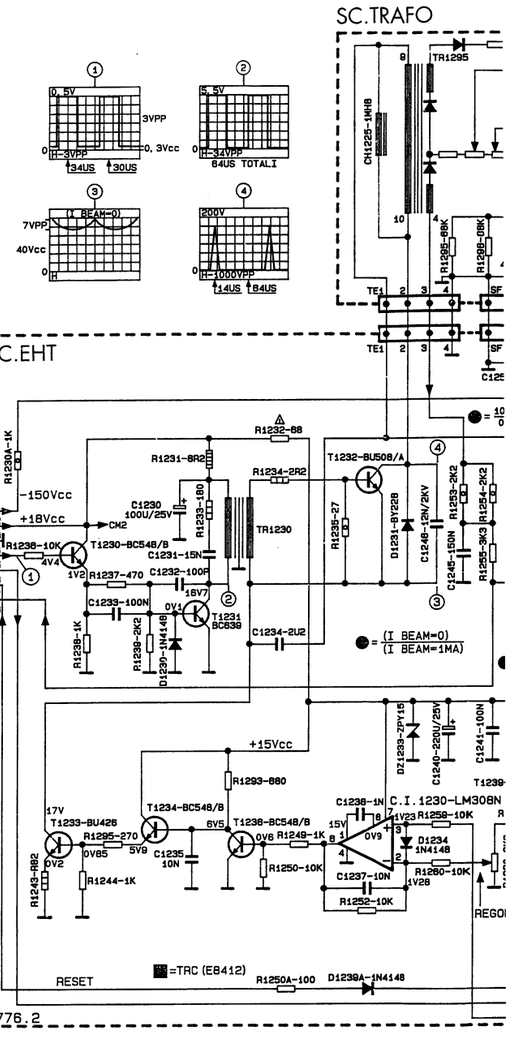
BS 840

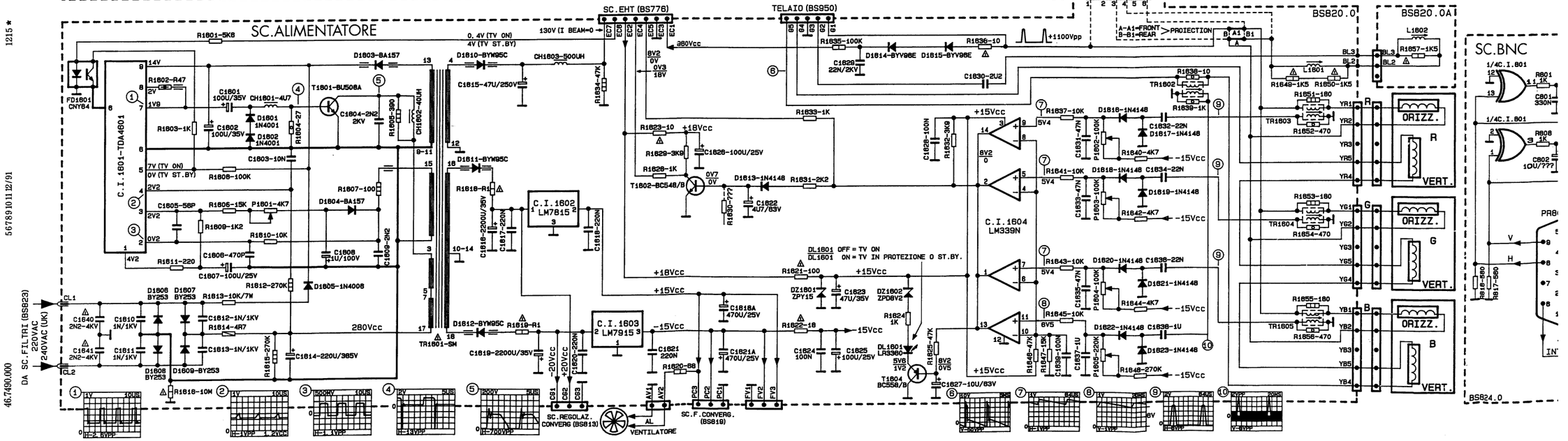


BS 812

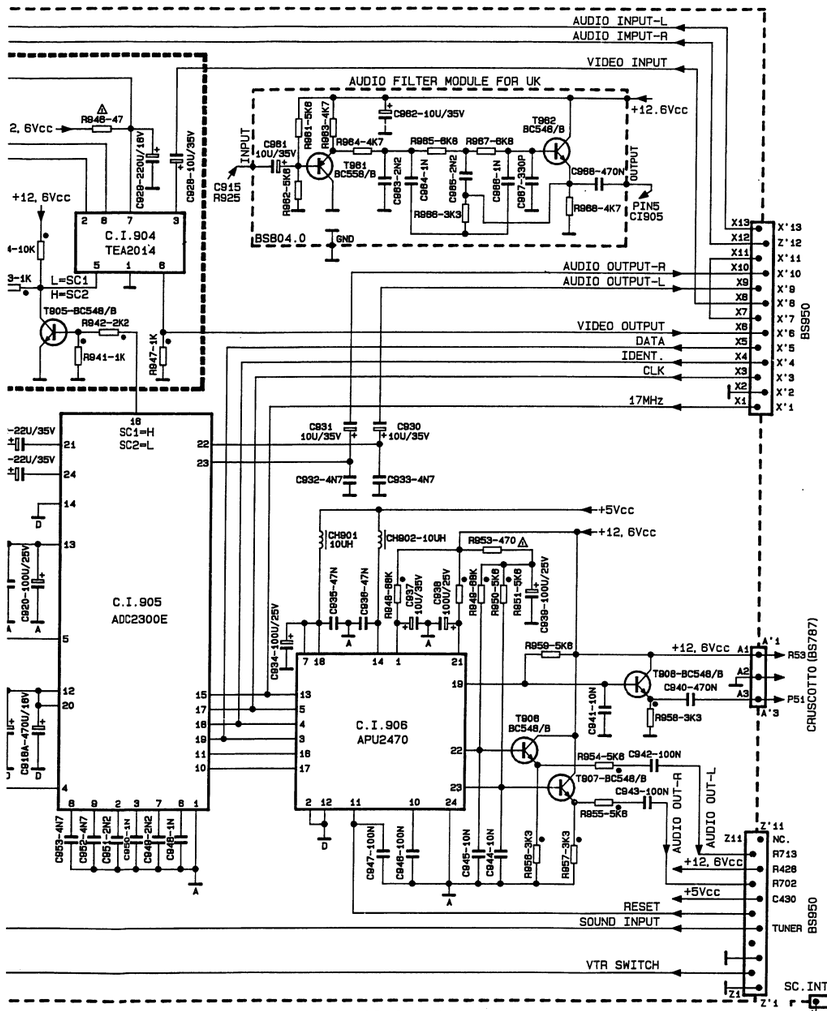
SC. AUDIO - ALIMENTATORE - BNC - EHT







RE - BNC - EHT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AUDIO INPUT-R
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AUDIO FILTER MODULE FOR UK
+12.6Vcc
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GND
C.I.904
TEA2014
+12, 6Vcc
L=SC1
H=SC2
T905-BC548/B
R942-2K2
R941-1K
R947-1K
AUDIO OUTPUT-R
AUDIO OUTPUT-L
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CLK
17MHz
BS950
C.I.905
ADC2300E
SC1=H
SC2=L
C.I.906
APU2470
+5Vcc
+12, 6Vcc
CHUSCOTTO (BS787)
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AUDIO OUT-L
RESET
SOUND INPUT
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VTR SWITCH
NC.
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R702
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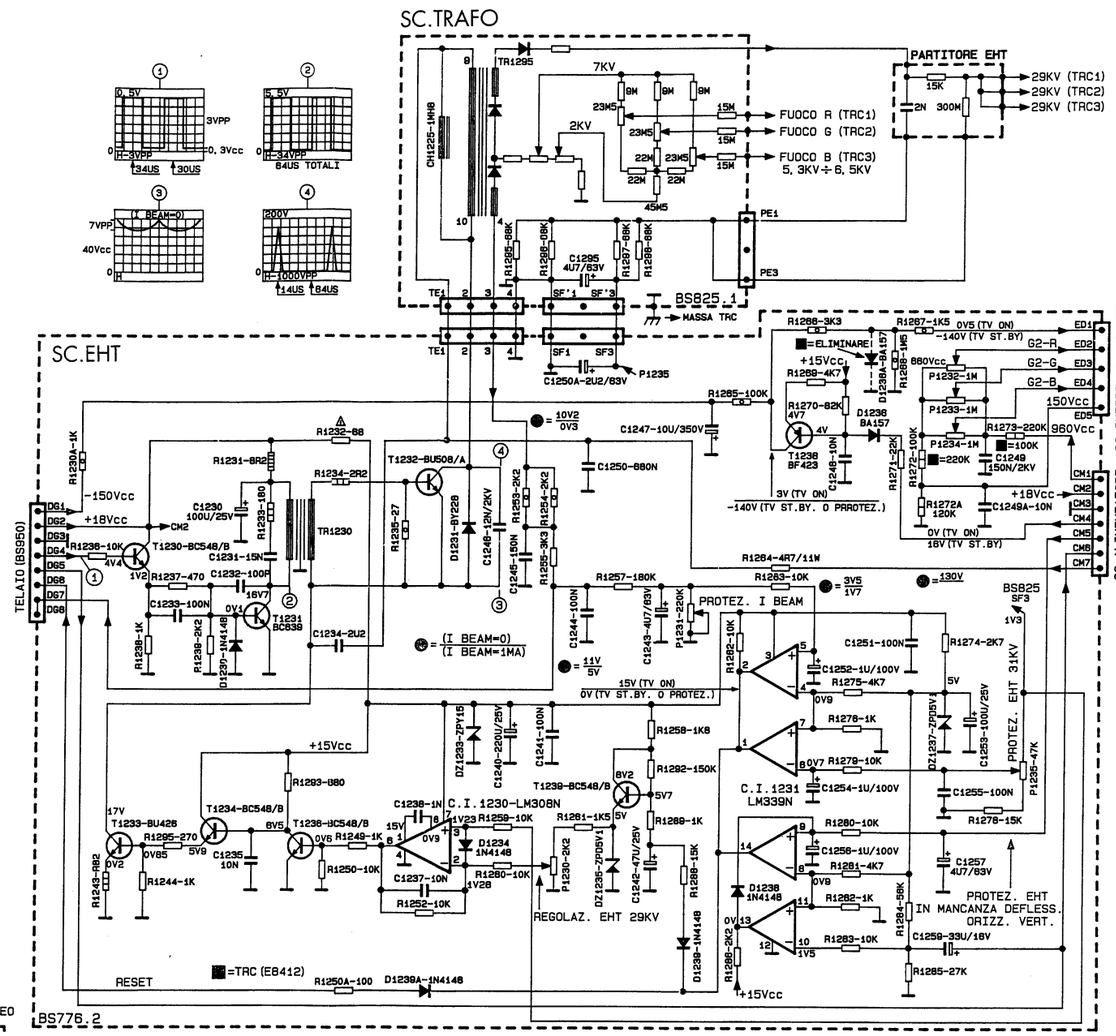
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SC.INTERFACCIA VIDEO
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REGOLAZ. EHT 29KV
PROTEZ. EHT 31KV
PROTEZ. EHT
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ORIZZ. VERT.
C.I.1230-LM308N
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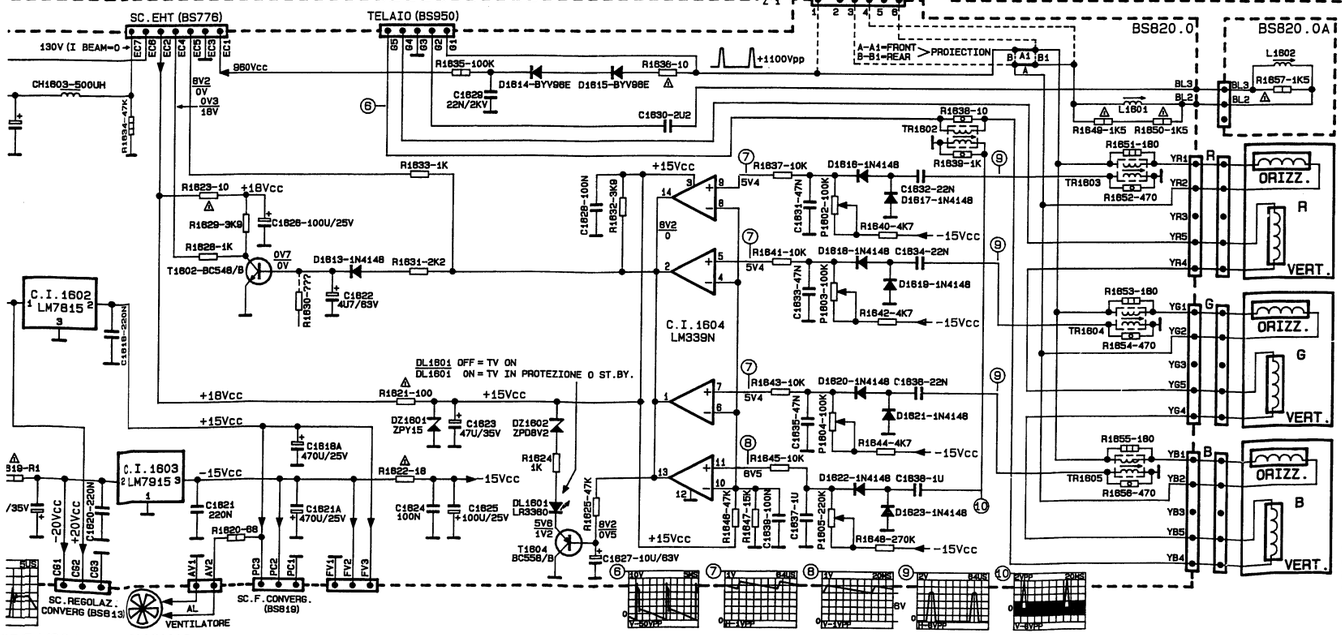
TELAIO (BS950)
BS776.2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TELAIO (BS950)
(BS840)
SC.INTERFACCIA VIDEO
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LM7815
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LM7915
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LM339N
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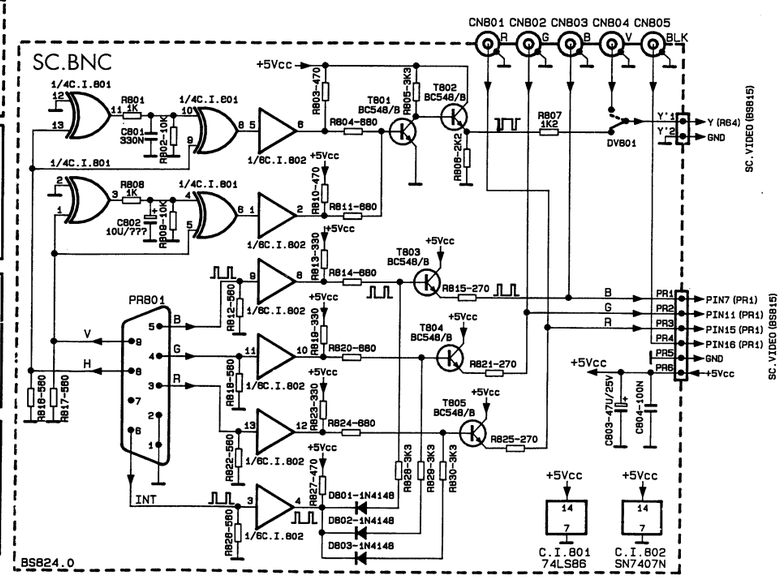
DL1801 ON = TV IN PROTEZIONE O ST.BY.
SC.REGOLAZ.
CONVERG (BS813)
SC.F.CONVERG.
(BS819)
VENTILATORE
ORIZZ.
VERT.
R
G
B


SC.BNC
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R
G
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INT
C.I.801
74LS86
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SN7407N
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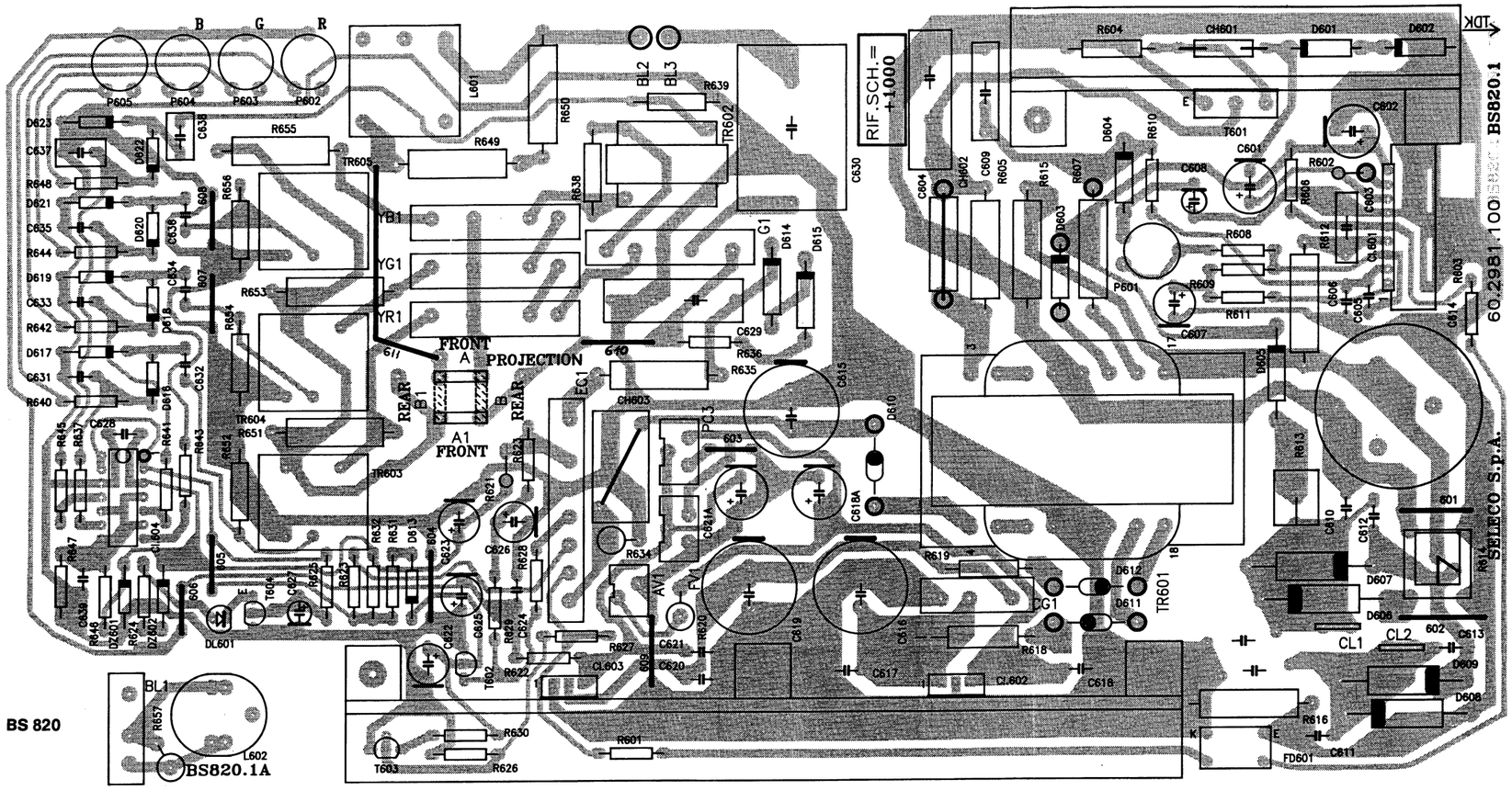
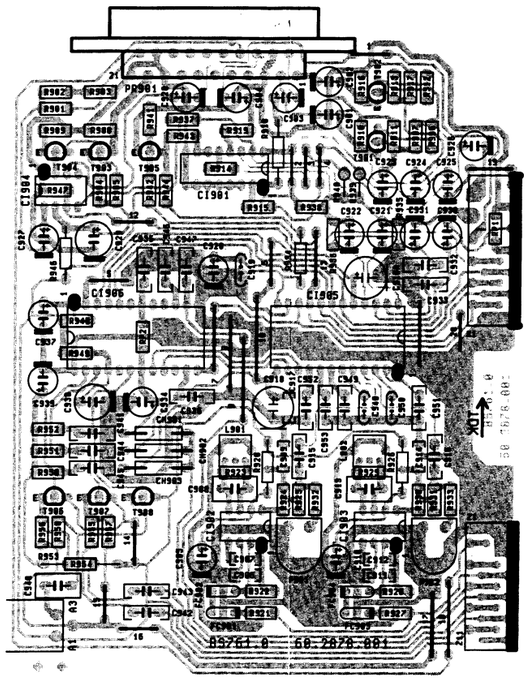
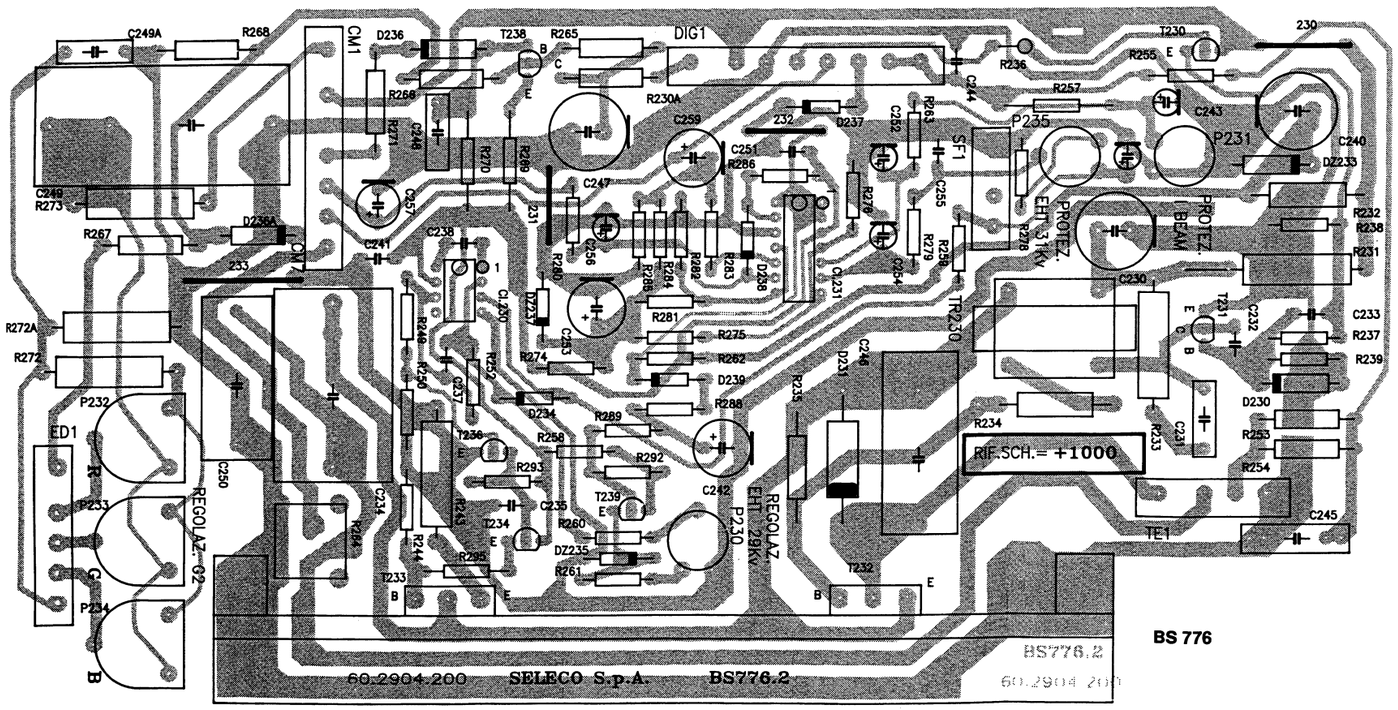


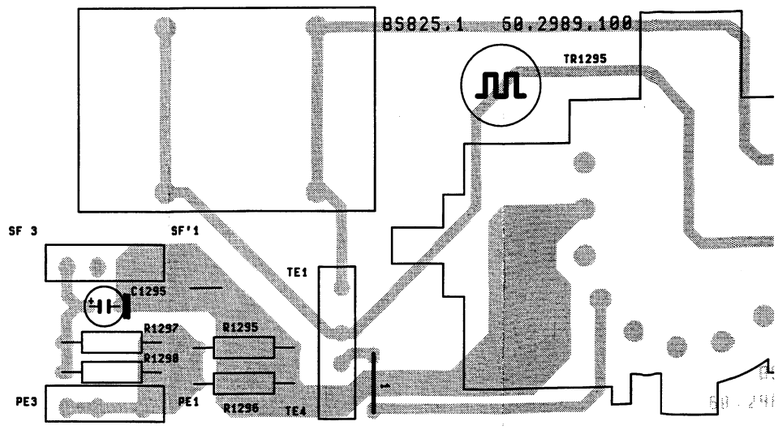
BS 820



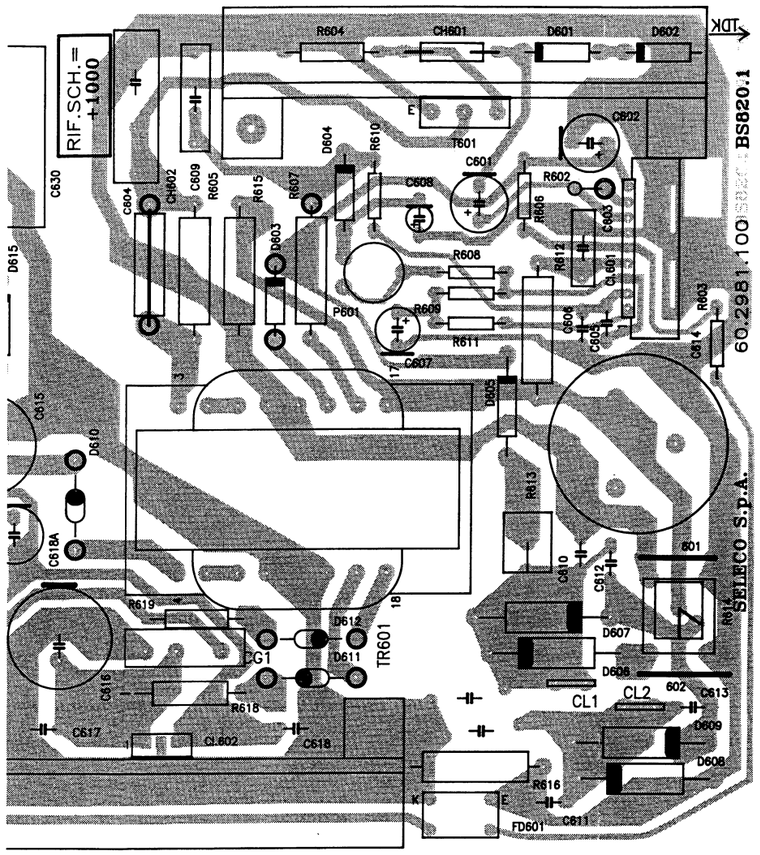
BS 761.0



BS 776



BS 825



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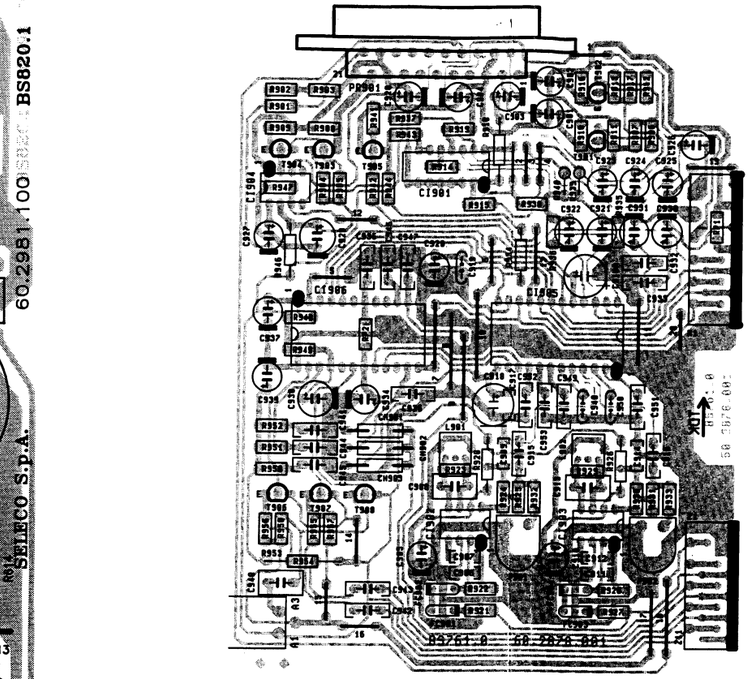
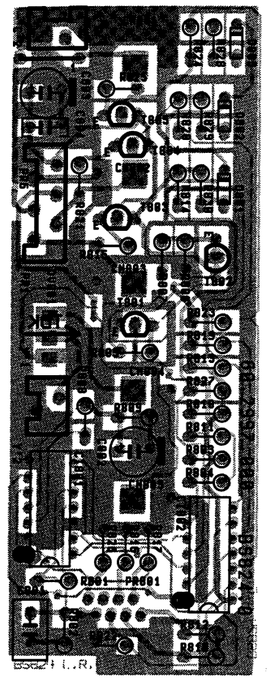
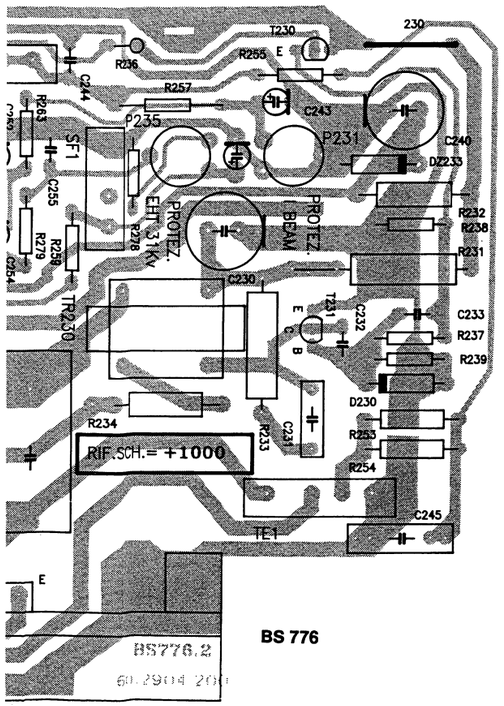
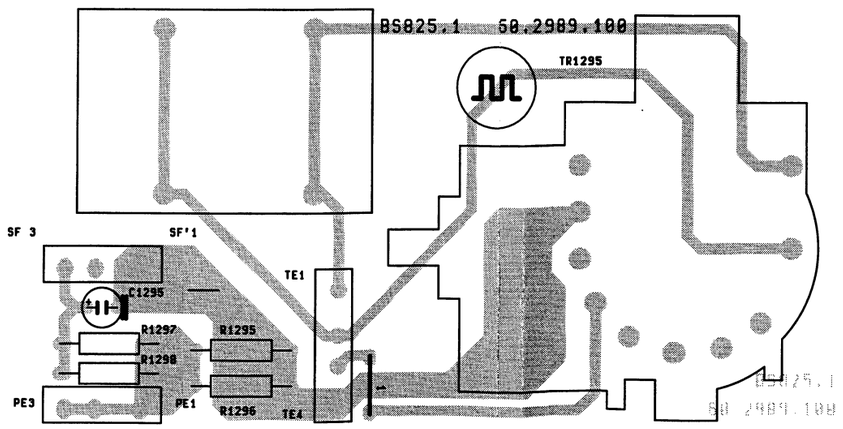




BS 824



BS 776



BS 825